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SCIENTIFIC ARTICLE

Perioperative analgesic efficacy of bilateral superficial cervical plexus block in patients undergoing thyroidectomy: a randomized controlled trial

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KEYWORDS
Superficial cervical plexus block;
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Abstract
Introduction: Bilateral superficial cervical plexus block (BSCPB) is a common method used for analgesia in thyroid surgery. We investigated the analgesic efficacy of bilateral superficial cervical plexus block in the intraoperative and postoperative periods.
Materials and methods: Patients (n = 46) undergoing thyroidectomy were randomly separated into the following 2 groups: the general anesthesia group (GA; n = 23) and the general anesthesia plus BSCPB group (GS; n = 23). The intraoperative analgesic requirement (remifentanil) and visual analog scale (VAS) score at multiple time points during the postoperative period (after extubation, at 15, 30 minutes and 1, 2, 6, 12, 24, and 48 hours post operation) were evaluated. Total tramadol and paracetamol consumption as well as the amount of ondansetron used was recorded.
Results: The intraoperative remifentanil requirement was significantly lower in the GS Group than in the GA Group ($p = 0.009$). The postoperative pain scores were significantly lower in the GS Group than in the GA Group at 15 ($p < 0.01$), 30 ($p < 0.01$) minutes, and 1 ($p < 0.01$), 2 ($p < 0.01$), 6 ($p < 0.01$), 12 ($p < 0.01$) and 24 ($p = 0.03$) hours. The postoperative tramadol requirement was significantly lower in the GS Group than in the GA Group ($p = 0.01$). The number of patients that used ondansetron was significantly lower in the GS Group than in the GA Group ($p = 0.004$).
Conclusion: We concluded that BSCPB with 0.25% bupivacaine reduces the postoperative pain intensity and opioid dependency in thyroid surgery patients.

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PALAVRAS-CHAVE
Bloqueio do plexo cervical superficial;
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Anestesia e analgesia

Eficácia analgésica perioperatória do bloqueio bilateral do plexo cervical superficial em pacientes submetidos à tireoidectomia: estudo clínico randomizado

Resumo
Introdução: O bloqueio bilateral do plexo cervical superficial (BPCS) é um método comumente usado para analgesia em tireoidectomia. Avaliamos a eficácia analgésica do bloqueio bilateral do BPCS nos períodos intraoperatório e pós-operatório.
Materiais e métodos: Os pacientes (n = 46) submetidos à tireoidectomia foram randomicamente separados em dois grupos para receber anestesia geral (Grupo GA; n = 23) e anestesia geral mais bloqueio bilateral do BPCS (Grupo GS; n = 23). Avaliamos a necessidade de analgésico no intraoperatório (remifentanil) e os escores VAS (Visual Analog Scale) em vários momentos no pós-operatório (após a extubação, aos 15 e 30 minutos e em 1, 2, 6, 12, 24 e 48 horas de pós-operatório). O consumo total de tramadol e paracetamol e a quantidade usada de ondansetrona foram registrados.
Resultados: A necessidade de remifentanil no intraoperatório foi significativamente menor no Grupo GS que no Grupo GA ($p = 0,009$). Os escores de dor pós-operatória foram significativamente menores no Grupo GS do que no grupo GA aos 15 ($p < 0,01$), 30 ($p < 0,01$) minutos e em 1 ($p < 0,01$), 2 ($p < 0,01$), 6 ($p < 0,01$), 12 ($p < 0,01$) e 24 ($p = 0,03$) horas de pós-operatório. A necessidade de tramadol no pós-operatório foi significativamente menor no Grupo GS que no grupo GA ($p = 0,01$). O número de pacientes que recebeu ondansetrona foi significativamente menor no Grupo GS do que no Grupo GA ($p = 0,004$).
Conclusão: O bloqueio bilateral do BPCS com bupivacaína a 0,25% reduz a intensidade da dor pós-operatória e a dependência de opioides em pacientes submetidos à tireoidectomia.

Introduction

Thyroidectomy is the most common procedure performed by endocrine surgeons.[1] Pain following thyroidectomy procedures may result from surgical incisions in the neck, orotracheal intubation, or hyperextension during surgery. Postoperative thyroid surgery pain is moderate in intensity and up to 90% of patients require narcotic analgesics on the first day after surgery.[2]

Inadequate postoperative pain control increases the level of stress hormones and the rate of perioperative complications.[3] General anesthesia alone is often insufficient as a postoperative analgesia; most patients require additional doses.[4]

Peripheral nerve blocks are a simple, safe and effective postoperative analgesic method.[5] Superficial cervical plexus block (SCPB) is used as preoperative and postoperative analgesia for neck surgery.[6] SCPB is the easiest and most common nerve block due to its bilateral applicability.[7–9] However, there is significant debate about the application of SCPB in thyroid surgery as postoperative analgesia. While Andrieu et al.[7] demonstrated that SCPB reduces the intraoperative and postoperative analgesic requirements, other studies have shown that SCPB does not have this effect in thyroid surgery.[10,11] Thyroid surgery carries high risks of postoperative nausea and vomiting[12] and narcotic analgesics increase these risks.[13]

This study investigated the efficacy of SCPB as an analgesic by measuring the visual analog scale of postoperative pain and the patients' postoperative analgesic requirements.

Methods

This study was approved by the local board of ethics (15-KAEK-055) of the Gaziosmanpasa University medical faculty and was registered as a clinical trial at ClinicalTrials.gov (http://www.clinicaltrials.gov) with the identification number NCT02680353. In this study, 46 patients underwent elective thyroid operations at the Gaziosmanpasa University Hospital from April 2015 to April 2016. Patients undergoing elective thyroidectomy under general anesthesia with scores of 1 or 2 (per the scoring system from the American Society of Anesthesiologists — ASA) were included. Patients with a history of allergies to local anesthetics, contraindication to regional anesthesia, coagulopathy, chronic use of opioid analgesics or opioid analgesic intolerance were excluded, along with patients who refused to be in the study.

The 46 patients were randomly divided into 2 groups using computer-generated random numbers. One group received only general anesthesia (GA Group), and the other group received general anesthesia plus bilateral superficial cervical plexus block (after induction of general anesthesia and before the skin incision) (GS Group). Each group included 23 patients.

After establishing a standard monitoring procedure for general anesthesia, all patients were intravenously administered thiopental sodium (4–5 $mg.kg^{-1}$), fentanyl

($1\ \mu g.kg^{-1}$), and rocuronium bromide ($0.5\ mg.kg^{-1}$). Anesthesia was maintained with oxygen 50%, air 50%, sevoflurane and remifentanil. Remifentanil was applied at concentrations of $40\ \mu g.mL^{-1}$, with initial doses starting at $0.1\ \mu g.kg^{-1}.min^{-1}$. The remifentanil doses were increased when the patient's mean arterial pressure or heart rate was 20% higher than the baseline values. The remifentanil doses were reduced when the mean arterial pressure was 20% less than the baseline values or if the patient's heart rate fell below 60. The mean intraoperative remifentanil consumption of all patients was recorded. After surgery, patients were admitted to the Postanesthesia Care Unit (PACU).

After the induction of general anesthesia, superficial cervical plexus blocks were administered bilaterally by an anesthesiologist before the incision. A 22 gauge needle was inserted at the midpoint of the lateral border of the sternocleidomastoid muscle. Using a three-point injection technique, 10 mL 0.25% bupivacaine (with a 2 mL needle replacement, 4 mL cephalad and 4 mL caudal) was administered bilaterally to block the branches of the plexus (10 mL on each side). After the removal of the thyroid tissue, 1000 mg paracetamol was given to all patients.

After their operations, all patients were sent to the PACU. Incidences of postoperative pain (including VAS scores), nausea, and vomiting were recorded by a member of the research staff. If a patient's pain on the VAS (where 0 meant no pain and 10 was the worst imaginable pain) was higher than 4, additional analgesia was administered intravenously (1000 mg paracetamol). If the patients' VAS values were still higher than 4, tramadol hydrochloride ($1\ mg.kg^{-1}$) was administered. If a patient experienced nausea or vomiting, ondansetron was administered. The patients' VAS scores were evaluated at 15, 30 minutes and 1, 2, 6, 12, 24, and 48 hours. The total paracetamol and tramadol hydrochloride consumption and the amount of ondansetron used were recorded for each patient.

Using the mean pain score values (6.9 ± 1.7) from the study conducted by Gozal et al.[1] as in the control group and assuming a 20% decrease in the pain score values after performing a superficial cervical plexus block with a Type I error of 0.05 and power of 0.80, the sample size was calculated to be 23 in each group. Qualitative data were expressed as numbers or percentages, and quantitative data were expressed as the mean and standard deviation. The Kolmogorov–Smirnov test was used to analyze the distribution of the data. In this context, parametric tests were applied to the data with normal distributions, while non normally distributed data were analyzed using nonparametric tests. The Chi-Square test and Mann–Whitney U test were used to analyze the qualitative data and quantitative data. Analysis of all data was performed using the Statistical Package for Social Sciences program version 20.0 (SPSS Inc, Chicago, IL). Statistical significance was accepted as $p < 0.05$.

Results

The demographics, duration of surgery, duration of anesthesia, degree of intubation difficulty (IDS), Cormack–Lehane (CL) classification, pain catastrophizing scale (PCS), body mass index (BMI), and smoking history in the 2 groups are summarized in Table 1. As shown in Table 1, we found no significant differences between the 2 groups.

We compared total analgesic consumption in the 2 groups including tramadol, paracetamol and remifentanil consumption. As shown in Table 2, the total tramadol, paracetamol and remifentanil requirements showed significant differences between the groups ($p < 0.01$, $p = 0.002$ and $p = 0.009$ respectively).

In Table 3, the number of patients using tramadol and ondansetron were significantly different between the groups ($p < 0.05$). The ondansetron and tramadol requirements during the first 24 h after thyroidectomy were significantly reduced in the GS Group compared within the GA group ($p = 0.004$ and $p < 0.001$, respectively).

We analyzed the VAS score after the operation in the 2 groups. The results showed that the VAS score at 15 min, 30 min, and 1, 2, 6, 12, and 24 h after operation was significantly lower in the GS group than in the GA group ($p < 0.05$). However, there was no significant difference in VAS score between groups at 48 h after the operation ($p = 0.622$) (Table 4).

Discussion

This study demonstrated that BSCPB with general anesthesia reduced postoperative pain and analgesic consumption in patients who underwent thyroid surgery compared to patients who received only general anesthesia. BSCPB in combination with general anesthesia can reduce intraoperative and postoperative analgesic requirements.[14]

In this study, VAS was the chosen method for pain assessment as VAS is sensitive and simple.[15] Compared to the patients' mean VAS scores at rest, we found that the GS Group's postoperative scores were significantly lower than those of the GA Group. There was no significant difference between groups 48 h postoperatively (Table 4). The patients felt a significant amount of pain in the first postoperative hours despite modern techniques.[16]

In a study by Kale et al.,[17] 60 thyroidectomy patients were divided into the following 3 groups: patients who received no block, those given preoperative BSCPB, and those who received postoperative BSCPB. The VAS (0–10) values of the 3 groups were evaluated at rest, during neck movements, and during speaking and swallowing actions. The VAS values were found to be the lowest in the group that received blocks in the first 48 h and were highest in the group that received no block. BSCPB performed prior to or after surgery was observed to significantly decrease the patients' pain post thyroidectomy and opioid requirement levels.[18]

The resting VAS values were significantly lower in the Block Group (GS) than in the Control Group (GA) in the present study. In Shis's study, the VAS values of the patients who received BSCPB were lower than those of the patients with no block, up to 24 h following thyroid surgery.[19] In the present study, the VAS values of the GS group were lower than those of the GA group in the first 24 h. This result demonstrates that the combination of BSCPB with general anesthesia served as a more effective analgesia than general anesthesia alone. Additionally, the postoperative VAS values of the control group (GA) at 15 min, 30 min and 1 h after the

Table 1 General parameters in two groups.

	Group GS	Group GA	*p*
Age (year)	49.26 ± 14.70	46.87 ± 14.19	0.602[a]
Gender (F/M)	17/6	15/9	0.401[b]
ASA (I/II)	6/17	9/15	0.401[b]
BMI ($kg.m^{-2}$)	26.41 ± 5.18	26.97 ± 6.01	0.949[a]
Smoker (+/−)	6 /17	8/16	0.587[b]
Duration of surgery	140.00 ± 41.76	147.75 ± 38.22	0.268[a]
Duration of anesthesia	154.91 ± 42.00	163.25 ± 37.27	0.212[a]
CL (I/II/III/IV)	13/8/2	13/6/5	0.461[a]
IDS	4.26 ± 1.95	5.33 ± 2.82	0.265[a]
PCS	17.13 ± 8.20	21.41 ± 11.75	0.179[a]

ASA, American Society of Anaesthesiologist; BMI, body mass index; F, female; M, male; CL, Cormack–Lehane grade; IDS, intubation difficulty scale; PCS, pain catastrophizing scale.
[a] Mann–Whitney U test, $p < 0.05$.
[b] Chi square test.

Table 2 Total analgeisc consumption in two groups.

	Group GS	Group GA	*p*
Tramadol (mg)	91.66 ± 32.5	240.86 ± 74.52	0.01[a]
Paracetamol (g)	2.83 ± 0.75	3.95 ± 1.14	0.002[a]
Remifentanil (mcg)	675 ± 468.77	819.56 ± 535.28	0.009[a]

[a] Mann–Whitney U test, $p < 0.05$.

Table 3 Number of patients using tramadol and ondensatron in two groups.

	Group GS	Group GA	*p*
Using ondansentron	2 (8%)	11 (45%)	0.004[a]
Using not ondansentron	21 (92%)	13 (55)	0.004[a]
Using tramadol	6 (26%)	24	0.000001[a]
Using not tramadol	17 (74%)	1	0.000001[a]

Data are mean ± SD or number of patients.
[a] Ki-Kare test, $p < 0.05$.

Table 4 The VAS score of patients.

	Group GS	Group GA	*p*
Postoperative 15th min	2.6 ± 0.54	5.62 ± 1.3	<0.01[a]
Postoperative 30th min	2.8 ± 0.44	5.12 ± 0.83	<0.01[a]
Postoperative 1st hour	2.8 ± 0.83	4.12 ± 1.12	<0.01[a]
Postoperative 2nd hour	2.2 ± 0.44	3.62 ± 1.18	<0.01[a]
Postoperative 6th hour	2.2 ± 0.83	2.87 ± 0.83	<0.01[a]
Postoperative 12th hour	1.6 ± 0.54	2.13 ± 0.53	<0.01[a]
Postoperative 24th hour	1.6 ± 0.54	1.87 ± 0.35	0.03[a]
Postoperative 48th hour	1.4 ± 0.54	1.75 ± 1.03	0.622[a]

[a] Mann–Whitney U test, $p < 0.05$.

procedure were greater than 4. General anesthesia patients felt intermediate levels of pain in the postoperative period that require opioids to treat.

The efficacy of post-thyroidectomy BSCPB on opioid consumption is a matter of debate. In the present study, the postoperative levels of tramadol and paracetamol consumption were significantly lower in the GS group than in the GA group. Tekgül et al.[20] also investigated the effects of BSCPB application on the postoperative requirements of tramadol. They applied 10 mL 0.5% levobupivacaine bilaterally using three-point techniques. Their study found that the block group required less tramadol than the

control group. Herbland et al.[11] conducted a prospective, randomized, and double-blind study that included 111 patients. They included a control group with no block and 2 block groups that received 0.75% ropivacaine, one group in the preoperative period and one group in the postoperative period. The pain scores, consumption of morphine and intraoperative opioid requirements were similar between the groups. Performing BSCPB using only 2 injections may not have blocked the cervical transverse branch of the plexus, which results in increased pain for the patient. In the present study, all branches of the plexus were blocked using three-point injection techniques, thereby reducing both the intraoperative and postoperative consumption of opioids.

Andrieu et al.[7] used BSCPB for thyroid surgery in their double-blind controlled study. They divided patients into 3 groups and performed blocks using 0.487% saline ropivacaine and clonidine plus 0.487% ropivacaine. The intraoperative use of sufentanil was significantly lower in the group that received both ropivacaine and clonidine than in the other two groups. In a similar study, Karthikeyan et al.[2] used 0.25% bupivacaine instead of ropivacaine. The analgesic consumption, VAS levels, and intraoperative fentanyl consumption were found to be significantly lower in the group that received BSCPB than in the group that did not receive BSCPB. Our study also found that intraoperative remifentanil use was significantly lower in the block group than in the group with no block.

Sonner et al.[12] reported that 54% of their patients experienced nausea and vomiting after thyroidectomy procedures. Staying in place for 24 h following surgery may increase nausea and vomiting.[21] Opioids are required to treat pain in most patients despite the application of non-steroid, anti-inflammatory analgesics; opioids may also increase the frequency of postoperative nausea and vomiting.[22]

As previously reported by Cai et al.,[23] BSCPB significantly reduces nausea and vomiting in the postoperative period. The incidence of antiemetic use was reported to be 8% and 45% in the Block and Control Groups, respectively, possibly caused by higher tramadol consumption in the Control Group.

As previously reported by Dieudonne et al.,[8] BSCPB using 0.25% bupivacaine plus epinephrine and bupivacaine with no epinephrine early in the postoperative period decreased the intensity of pain during the first 2 postoperative hours and decreased the opioid requirement compared to general anesthesia alone. Performing the block after the surgery was reported to increase the analgesic requirement in the postoperative recovery unit due to the slow-acting nature (>20 min) of bupivacaine. Epinephrine was added to increase the analgesia's effective duration for blocks performed in the early postoperative period. The authors concluded that BSCPB did not provide optimal pain treatment for postoperative analgesia and that analgesia should be supplemented using multimodal approaches. Our study performed BSCPB prior to the incision and after intubation to act as both intraoperative and postoperative analgesia. Two-thirds of the patients in the GS group did not require opioids and required only 3 g paracetamol daily to effectively treat their pain. Based on these results, we suggest that well-performed BSCPB combined with paracetamol is an efficient method for analgesia.

Suren et al.[24] supplied PCS forms with 13 questions for a total of 52 points to 136 males and 121 females who underwent elective operations at this clinic. The correlation of the PCS demographics to the clinical characteristics of the Turkish population was analyzed. Helplessness, magnification and rumination were the three subgroups of the Turkish PCS. The PCS scores in this study were compatible with the findings from the literature. On the forms, 165 patients were asked to give points (from 0 to 10) prior to the introduction of vascular access. A positive correlation was found between the pain felt during the introduction of vascular access and PCS; it was suggested that clinicians should be alert to postoperative pain in patients with high levels of pain during vascular access placement. The PCS scores also tended to be high in female patients and patients with chronic pain.[25] In our study, the postoperative VAS values differed between the groups, but no statistically significant difference was present between the two groups' PCS scores. Lower VAS levels in the GS Group than in the GA Group might indicate that presumed pain can be decreased by an efficient analgesic method.

BSCPB was preferred in this present study because BSCPB acts as an efficient analgesia and can be applied bilaterally. No complications associated with the block, such as hematoma, nerve damage, or infection, were observed in the patients. These findings support the claim that BSCPB is a low-risk method with low rates of related complications.

In conclusion, BSCPB is an easily applicable and efficient method that decreases the analgesic requirement in patients during and following thyroid surgery. As an additional benefit, BSCPB decreases the need for antiemetic use to treat nausea and vomiting following thyroid surgery.

Conflicts of interest

The authors declare no conflicts of interest.

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