The Bilateral Superficial Cervical Plexus Block With 0.75% Ropivacaine Administered Before or After Surgery Does Not Prevent Postoperative Pain After Total Thyroidectomy

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Background and Objectives: Patients undergoing thyroid surgery need postoperative pain management. Bilateral superficial cervical plexus block by administration of 0.25% bupivacaine with 1:200000 epinephrine at the end of surgery has been shown to improve postoperative analgesia. The objective of this study was to assess the analgesic efficacy in the first 36 postoperative hours after total thyroidectomy of bilateral superficial cervical plexus block with 0.75% ropivacaine administered before the incision or on completion of the surgical procedure.

Methods: We performed a prospective double-blinded, randomized controlled trial that compared 3 parallel groups: the CONT group did not receive any block, the PRE group received bilateral superficial cervical plexus block before surgery while under general anesthesia, and the POST group received bilateral superficial cervical plexus block after surgery while under general anesthesia. The study included 111 patients (37 in each group). Postoperative pain was assessed every 4 hours by use of a 0 to 10 numeric rating scale. All patients received paracetamol every 6 hours. Morphine was administered following a standardized protocol if the numeric rating scale was 4 or higher. The main outcome variables were the proportion of patients given morphine during the 36 hours period, pain intensity scores, and morphine consumption.

Results: No intergroup differences were observed in terms of percentage of patients who required morphine, morphine delivery, pain scores, and intraoperative opioid consumption.

Conclusions: Bilateral superficial cervical plexus block with 0.75% ropivacaine administered before or after surgery does not improve postoperative analgesia after total thyroidectomy. *Reg Anesth Pain Med 2006;31:34-39.*

Key Words: Cervical plexus block, Thyroidectomy, Regional anesthesia, Postoperative analgesia.

Total thyroidectomy is recognized as a surgical procedure that causes mild to moderate postoperative pain for up to 48 hours. Few studies have addressed this issue.[1-3] Some authors have reported that 90% of patients required morphine during the first 24 hours of the postoperative period,[3] and others showed that the mean pain score in the same period was 6.9 on a 0 to 10 visual analog scale (VAS).[1] Despite moderate surgical pain, minimizing narcotic consumption in those patients at risk for airway compromise may be of value.

Some authors have showed that combined deep and superficial cervical plexus block with 0.5% ropivacaine administered before thyroid surgery under general anesthesia is an effective technique to reduce opioid analgesic requirements during and after surgery.[4] However, the authors concluded that the exact extent of the additional risk for the patients remains to be evaluated by large-scale studies. Indeed, the bilateral deep cervical plexus block is technically more difficult to perform and may be associated with more serious complications than the bilateral superficial cervical plexus block (BSCB).[5] BSCB is safe and simple, and the efficacy of this technique in preventing postoperative pain after thyroid surgery has only been tested in 1 study.[3] In

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this placebo-controlled trial, BSCB was performed at the end of surgery. As a result, a smaller proportion of patients were given morphine (66.0% *v* 90.0%) and the initial median pain intensity scores were reduced. In these 2 studies, the control group received cervical plexus blocks with saline as control. Subcutaneous injection of saline may possibly have caused superficial cervical pain and may have introduced a confounder in postoperative pain assessment. Moreover, the best time to perform the block remains to be evaluated.

The goal of this randomized, controlled, double-blinded trial that compared 3 groups was to assess the analgesic efficacy of BSCB performed with 0.75% ropivacaine before or after total thyroidectomy. The outcome parameters assessed were the total use of morphine and the pain intensity scores in the first 36 postoperative hours.

Methods

Our institutional committee for human investigations approved the study and written informed consent was obtained from each patient. Adults with ASA physical status I to III scheduled for total thyroidectomy without cervical lymph node dissection under general anesthesia were eligible for the study.

Exclusion criteria included any history of thyroid surgery, intolerance or contraindication to any medication used in the study, and inability to understand the study protocol and the numeric rating scale (NRS) for pain assessment. Patients were not included if they had recently used opioids, corticosteroids, or any analgesic drug that could interfere with postoperative analgesic requirements.

Patients were premedicated with hydroxyzine 100 mg (orally) at 8:00 PM the day before and 1 hour before the time of surgery. The anesthetic protocol was identical for all the patients: general anesthesia was induced by intravenous propofol supplemented with 0.3 μg/kg of intravenous sufentanil. Orotracheal intubation was facilitated by the administration of intravenous cisatracurium (0.15 mg/kg). Anesthesia was maintained by total intravenous anesthesia (TIVA) with propofol titrated to effect. Supplemental sufentanil was given in doses of 10 μg when necessary. Patients were ventilated with air/O_2 (1/1) mixture. Thyroid surgery was performed according to a standardized procedure by 4 surgeons of the same unit. Thirty minutes before the end of surgery, patients received intravenous paracetamol (15 mg/kg).

On the morning of surgery, patients were randomized into 3 groups. A sealed envelope contained the group assignments determined from a table of randomized numbers. The CONT group did not receive any block, the PRE group received BSCB before incision but after induction of general anesthesia, and the POST group received BSCB on completion of the surgical procedure before waking up. An anesthesiologist performed BSCB by use of an accepted technique.[6] In both sides of the neck, a subcutaneous infiltration of 10 mL of solution was made by use of a 22-gauge needle inserted in the middle point of the posterior board of the sternocleidomastoid muscle. After negative aspiration, infiltration was made in 2 directions: 5 mL of solution (0.75% ropivacaine) was injected up and down to block the main branches of the superficial cervical plexus (lesser occipital, greater auricular, transverse cervical, and supraclavicular nerves). No testing was possible at any time to demonstrate that blocks were effective because of general anesthesia. The specific treatment given was unknown to the patient and to the nurse in charge of pain assessment.

Postoperative pain management was standardized as follows. Pain scores were assessed by use of an NRS (0: no pain; 10: worst imaginable pain). All patients received preoperative instruction on the use of the NRS. In the postanesthesia care unit (PACU), patients stayed for 2 hours and were interviewed when fully awake by a nurse trained in pain assessment. In the ward, a nurse trained in pain assessment interviewed patients every 4 hours. A peripheral intravenous catheter was maintained for 24 hours. In the PACU, morphine was administered in 2-mg intravenous increments every 5 minutes when the pain score was 4 or higher at rest. In the ward, pain scores were evaluated every 4 hours and 5 mg of morphine was given intravenously (or subcutaneously after the first 24 postoperative hours) if the pain score was 4 or higher at rest. During the postoperative period, paracetamol (15 mg/kg) was systematically administered intravenously every 6 hours for the first 24 hours and orally for the next 24 hours.

Patients were allowed to eat 24 hours after the surgical intervention. During the first 36 postoperative hours, all episodes of postoperative nausea and vomiting (PONV) were recorded, continuously in the PACU and every 4 hours in the ward either by direct questioning by the nurse in charge of pain assessment or by spontaneous complaint by the patient. The nurse asked the patient if retching or vomiting had occurred and if they felt nauseated, with only 2 possible answers (yes/no). PONV was treated with 4 mg of intravenous ondansetron to a maximum of 3 doses a day.

The primary outcome was the proportion of patients who had a pain score of 4 or higher and were subsequently given morphine at any time during

the first 36 postoperative hours. The secondary outcomes included the time span between extubation and the first morphine request, the maximal pain scores in the PACU (H0), before discharge from the PACU (H2), and every 4 hours in the ward (H4, H8, etc.). Also noted was the morphine delivery for each group, incidence of PONV in the PACU, in the ward, and in the first 36 postoperative hours. Other parameters were recorded: intraoperative sufentanil and propofol requirements, length of general anesthesia and surgery, and time to extubation. Adverse events were fully recorded, especially any side effects related to the regional anesthesia technique.

On the assumption that BSCB would reduce the proportion of patients who required morphine (estimated at 90%) by 30%, the number of patients required in each group to observe such reduction was at least 35, with $\alpha = 0.05$ and $\beta = 0.1$.

Continuous variables with normal distribution are reported as mean ± SD and were analyzed by application of analysis of variance. The other quantitative variables are reported as median and range because their distribution was expected to be skewed, and the differences between groups were analyzed by application of a nonparametric Kruskal-Wallis test. Categorical variables are reported as proportions and were analyzed by application of χ^2 tests, with continuity correction if appropriate. Nonparametric variables are reported as median and range and were analyzed by use of the Kruskal-Wallis test. A value of $P < .05$ was considered significant.

Results

A total of 111 patients were enrolled and completed the study protocol; 37 patients were in each group. Demographic, clinical characteristics, and intraoperative data were similar in the 3 groups (Table 1). No statistically significant differences were seen in the time span between cessation of propofol infusion and extubation.

The proportion of patients who had an NRS score of 4 or higher and subsequently needed morphine was not significantly different in the 3 groups in the PACU, in the ward, or in the total postoperative period of 36 hours (Table 2). Median-intensity pain score at each moment of pain evaluation (H0, H2, H4, H8, . . . H36) was not significantly different among the 3 groups in the postoperative period (Fig 1). The time span before the first analgesic request in the PACU and morphine requirements did not differ in the 3 groups at any postoperative period of the study (PACU, ward, or total 36 hours) (Table 2).

The incidences of PONV observed during the entire observation period were, respectively, 40.5% in the CONT group, 24.3% in the POST group, and 37.8% in the PRE group. These results were not significantly different for this period, either in the PACU or in the ward (data not shown).

On recovery, 1 patient in the POST group presented left brachial paresthesias that were completely resolved in 2 hours. One patient in the PRE group had a partial motor block of the right arm that completely resolved in 4 hours.

Discussion

Our results show that BSCB with 0.75% ropivacaine performed before or after surgery reduced neither the proportion of patients who required morphine nor the morphine requirement (mg) and other pain parameters after total thyroidectomy.

As reported by another author,[7] pain after thyroidectomy in our study postoperative was also brief. The median pain scores recorded in the CONT group decreased after morphine titration at H2 in the PACU (Fig 1) and continue to decrease over the postoperative period to reach a median pain score of 1 at H36. However, in our study 89.2% of pa-

Table 1. Demographic and Perioperative Data

	CONT Group (n = 37)	POST Group (n = 37)	PRE Group (n = 37)
Weight (kg)*	70.2 ± 15.8	66.2 ± 13.4	65.9 ± 11.5
Male/female	8/29	5/32	4/33
Age (y)*	42.2 ± 15.8	45.8 ± 8.4	49.3 ± 13.2
Height (cm)*	166.4 ± 8.1	166 ± 6.8	163.2 ± 7
ASA 1/2/3 (n)	21/13/3	21/16/0	20/16/1
Duration of surgery (min)†	63 (45–165)	59 (55–180)	69 (55–180)
Duration of anesthesia (min)†	86 (90–240)	83 (80–215)	93 (85–300)
Intraoperative sufentanil ($\mu g^{-1}/kg^{-1}/min$) 10^3†	5 (3.3–11.5)	5 (3.9–14.2)	5 (3.8–15.8)
Intraoperative propofol ($\mu g^{-1}/kg^{-1}/min$) 10^3†	90 (15–296)	95 (56–253)	89 (69–317)
Time to extubation (min)†	24 (5–75)	24 (5–70)	25 (0–70)

Abbreviations: CONT, control group; POST, block placed after surgery; PRE, block placed before surgery.
*Means ± standard deviation.
†Median (range).

Table 2. Postoperative Analgesic Requirements and Incidence of PONV

	CONT Group (n = 37)	POST Group (n = 37)	PRE Group (n = 37)	*P* Value
Delay for the first morphine request (min)†	21 (0–85)	28 (0–90)	25 (0–70)	0.15
Morphine required n (%)				
In PACU	33 (89.2)	30 (81.1)	32 (86.5)	0.7
In the ward	17 (45.9)	12 (32.4)	15 (42.8)	0.49
Total 36-hour period after surgery	33 (89.2)	30 (81.1)	34 (91.9)	0.45
Morphine consumption (mg)†				
In PACU	5 (0–20)	5 (0–14)	5 (0–14)	0.56
In the ward	2 (0–9)	3 (0–15)	2 (0–9)	0.77
Total 36-hour period after surgery	6 (0–20)	6 (0–25)	6 (0–17)	0.55

Abbreviations: CONT, control group; POST, block placed after surgery; PRE, block placed before surgery.
†Median (range).

tients in the control group needed morphine during the total postoperative period. This result corresponds with 3 other studies that evaluated postoperative analgesia after thyroid surgery and revealed proportions from 90% to 92.5% of patients who needed morphine during the first 24 hours after surgery.[1,3,7] Morphine consumption essentially took place in the PACU during titration; only few patients required morphine in the ward (Table 2). Subsequently, our study confirms that a high proportion of patients require acute pain control essentially for the first hours after thyroid surgery.

Median morphine consumption in the control group was 6 mg for the first 36 hours after surgery. Surprisingly, this amount appears to be less than total morphine consumption observed for the 24 postoperative hours after thyroidectomy in the studies by Gozal et al.[1] and Dieudonne et al.,[3] in which the mean consumption was, respectively, 11.7 mg and 12 mg. One explanation could be that in the last 2 studies, control groups received bilateral cervical saline injections, a possible source of pain. In contrast, in our investigation, the control group did not receive any cervical injection. Other authors have already discussed the theoretical consequences of saline as a placebo solution use on nociception.[3,8] However, to our knowledge, no prior study has addressed this issue.

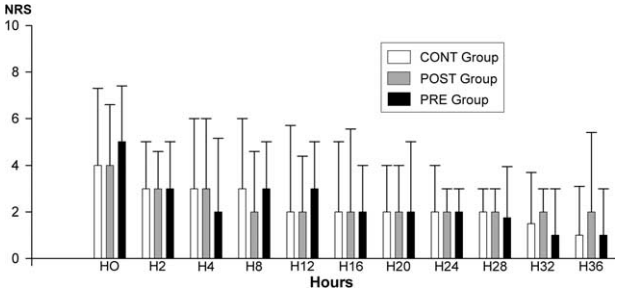

Fig 1. Pain scores on the numeric rating scale (NRS) at admission to the postanesthesia care unit (H0), before discharge from the postanesthesia care unit (H2), and at 4, 8, 12, 16, 20, 24, 28, 32, and 36 hours after thyroidectomy. The box represents the median. Error bars above the box mark the 90th percentiles. No significant difference was noted among the 3 groups at any time.

Although 4 surgeons were involved in the study, they operated with the same standardized procedure; the durations of surgical intervention and anesthesia were similar in the 3 groups. This method allows us to limit potential confounders for the analysis of the operative and postoperative parameters studied. Our study did not show any statistical difference between the 3 parallel groups. Given these negative results, we have calculated that with the same prior proportion of 90% of patients who need morphine, the sample size of 111 (37 patients in each group), and the expected reduction lowered from 30% to 25%, the type II error of our study was 20%, with a 5% level of significance. When the expected difference is reduced from 30% to 25%, the study keeps a statistical power of 80%, a commonly accepted level of power for randomized controlled trials. Therefore, our negative results are supported by the strength of the statistical methodology used.

Despite a randomized double-blinded procedure, interpretation of the data in this study must take into consideration several potential limitations. Although this study was designed to describe the potential postoperative analgesic effect of BSCB after total thyroidectomy, we did not confirm the effect of BSCB. Indeed, no testing was possible at any time to document that BSCB was effective. BSCB was performed under general anesthesia, so the immediate evaluation of the block was impossible. In the PACU, the presence of the adhesive bandage that protected the surgical wound and the suction drains did not permit inclusion of the assessment of sensory block in our protocol.

Another potential criticism is that we performed BSCB with a 2-injection method (caudal and rostral directions). This method, described by several au-

thors,[6,9,10] was modified from the initial description of Labat[11] and consists of deposition of local anesthetic solution midway along the length of the posterior board of the sternocleidomastoid muscle to block the main emerging branches of the superficial cervical plexus (lesser occipital, greater auricular, transverse cervical, and supraclavicular nerves). A 3-injection method is described by other authors[3,12] and consists of completion of the 2-injection method, with a third subcutaneous transverse injection to ensure the block of the transverse cervical branches. Dieudonne et al.[3] recently showed that BSCB with bupivacaine 0.25% and 1:200000 epinephrine performed by a 3-injection method at the end of surgery reduces pain intensity in the postoperative period after thyroid surgery. Our study failed to demonstrate this result by use of BSCB with more concentrated local anesthetic (0.75% ropivacaine) administered before or after surgery, despite larger volumes of solution (10 mL *v* 8 mL). The possibility of an incomplete sensory block of this part of the superficial cervical plexus cannot be excluded in our investigation and could explain the different results observed. From an anatomic viewpoint, the thyroid gland is located in the anterior triangle area, which has a superficial compartment (skin, subcutaneous tissue, and investing layer of deep fascia) innervated by the transverse branches of the superficial cervical plexus. Consequently, we believe that the extension of the block to the transversal cervical branches is a condition of analgesic efficacy after thyroidectomy. Recently, some authors have studied the spread of injectate with superficial cervical plexus block in humans.[13] This anatomical study showed that methylene blue dye did not spread beyond the subcutaneous tissue after subcutaneous injection in this cervical area (i.e., superficial to investing fascia but below the skin). In light of this recent finding, we believe that the 3-injection method for BSCB may facilitate the complete block of the transverse branches by deposition of local anesthetic solution in the area of the superficial distribution of these branches. However, no comparisons of the two methods of BSCB have been made, so an argument that one method provides a better block than another is difficult to make. A study that compares the two methods would be of interest.

Ropivacaine was chosen because it is known to be less cardiotoxic after intravenous administration than bupivacaine, even at an equipotent dose.[14,15] This characteristic is an important advantage when relatively large volumes of local anesthetic are administered in a highly vascularized area. Also, ropivacaine is currently used to perform carotid endarterectomy under regional anesthesia with combined deep and superficial cervical plexus block.[16] Moreover, Aunac et al.[4] showed that combined deep and superficial cervical plexus block with 0.5% ropivacaine is an effective technique to alleviate pain immediately after thyroidectomy. In addition, some authors have reported the efficacy of local infiltration with ropivacaine for postoperative pain relief after inguinal hernia repair.[17]

Patients undergoing thyroid surgery are at high risk for PONV (55% to 65%).[18,19] The incidence of PONV in the control group and in the 2 experimental groups is particularly low (24.3% to 40.5%) in our study. The anesthetic regimen was designed to decrease the risk of PONV. Except for the use of morphine in the postoperative period, a risk factor for PONV, we otherwise followed consensus guidelines in avoiding emetogenic agents and using propofol.[20-22]

In summary, BSCB with a 2-injection method that uses 0.75% ropivacaine, performed either before or after total thyroidectomy under general anesthesia, did not decrease either the proportion of patients who needed morphine or the postoperative pain parameters during the first 36 postoperative hours.

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