Bilateral Superficial Cervical Plexus Block Alone or Combined with Bilateral Deep Cervical Plexus Block for Pain Management After Thyroid Surgery

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ABSTRACT

Background and Objectives: Patients undergoing thyroid surgery need postoperative pain management. Bilateral superficial cervical plexus block (BSCBs) has been shown to improve postoperative analgesia. The objective of this study was to assess its analgesic efficacy in the first 24 hours after thyroid surgery alone and when combined with bilateral deep cervical plexus block (BDCBs).

Methods: We performed a prospective randomized and controlled study that compared 3 equal parallel groups, 12 patients each: Group A, received (BSCBs) before surgery and under general anaesthesia with 10 ml of bupivacaine 0.5% and epinephrine 1:200,000 in each side. Group B received (BSCBs) as in group A with (BDCBs) with 5 ml bupivacaine 0.5 % and epinephrine 1:200,000 at the level of C3. Group C: received general anaesthesia without any block. Postoperative pain was assessed by the use of a 0-10 numeric rating scale.

All patients received paracetamol every 6 hours. Morphine was administered following a standardized protocol if the numeric rating scales was 4 or higher. The main outcome variables were the proportion of patients given morphine during the 24 hours postoperatively, pain intensity scores, and total morphine consumption.

Results: There was no significant difference among the 3 groups as regards their demographic data. Both groups A&B were significantly superior to the controlled group C as regards percentage of patient required morphine, pain scores and postoperative morphine consumption. In comparison between groups A&B, there was no significant difference between the 2 groups as regards the main outcome variables. ($P < 0.05$).

Conclusion: Bilateral deep cervical plexus block does not add significant analgesic efficacy or has a narcotic saving strategy when combined with bilateral superficial cervical plexus block for pain control after thyroid surgery.

Key words: (Analgesics, opioid: morphine. Anaesthetic technique: cervical plexus block; superficial, deep. Anaesthetic, local: bupivacaine. Pain: postoperative. Surgery, thyroidectomy)

INTRODUCTION

Anaesthesia for thyroid surgery may appear quite simple as surgical stimulation during dissection of the gland is gentle in uncomplicated cases to the degree that being successfully performed under regional anaesthesia or hypnosis only\textsuperscript{(1,2)}. In contrast; when general anaesthesia is used for thyroid surgery, it is relatively a deep one! This is probably related to the combination of surgery and frequent tracheal stimulation associated with movement of endotracheal tube during surgical manipulation. Deep anaesthesia may delay recovery, so the use of short acting opioids appears to be a favorite choice, but postoperative hyperalgesia is a major disadvantage\textsuperscript{(3)}. In one study, the mean pain score reported after thyroidectomy was 6.9 on a Visual Analogue Scale (VAS) from 0 to 10 and 90% of patients required morphine\textsuperscript{(4)}. Along with the desirable effects of analgesia and anaesthesia, opioids produce a number of unwanted effects such as: nausea, vomiting, urinary retention, somnolence and hypoventilation. If the dose of opioids is reduced, these unwanted effects may be attenuated, but the efficacy of the analgesia might be less than optimal. Therefore, other analgesic methods have been adopted such as, non-opioid analgesics, regional
blocks and wound infiltration with local anesthetics solution\(^{(5)}\). Both superficial and deep cervical plexus blocks had been described for pain management after thyroid surgery, but their results were inconsistent and not inclusive\(^{(6,7)}\). The aim of this study was to assess the postoperative analgesic efficacy of bilateral superficial plexus block (BSCBs) alone and when combined with bilateral deep cervical plexus block (BDCBs) after thyroid surgery.

**METHODS**

This study was approved by the Hospital Ethics Committee. Written informed consent was obtained from all patients to participate in this study. Thirty-six patients, ASA physical status I-II scheduled for elective thyroid surgery under general anaesthesia were enrolled in this study. All patients were euthyroid before surgery; the same surgeon performed all the procedures, which always took place between 7:30 and 11:30 am. Exclusion criteria included 1) known hypersensitivity or contraindication to any of the study medications, 2) Recently received corticosteroids, opioids, or any other analgesic drugs, 3) Inability to understand the study protocol or the pain scale.

All the patients were instructed the day before surgery about the study protocol and the use of the VAS. Patients were premedicated with midazolam 15 mg orally thirty minutes before surgery. Anaesthesia was induced with IV remifentanil 1 µg/kg and propofol 2 mg/kg. Rocuronium 0.6 mg/kg was used to facilitate orotracheal intubation. Anaesthesia was then maintained with remifentanil 0.1-0.5 µg/kg/min and propofol 6 mg/kg/hr using 2 separate infusion syringes (Diprifusor, Graseby 3500 by SIMS Watford Herts, UK). Remifentanil infusion rate was adjusted to maintain blood pressure and heart rate within 20% of preinduction values. Mechanical ventilation was maintained with 40 - 50 % oxygen in air and mechanically adjusted to maintain \(P_{ET}CO_2\) between 4.6-5.2 KPa. A high-vacuum wound drainage system (Jackson - Pratt 10 Fr round, by Cardinal Health, McGow Park, IL, USA) was inserted in all patients.

At the cessation of surgical procedure, remifentanil and propofol infusions were stopped. Residual neuromuscular blockade was reversed with I.V neostigmine 0.05 mg/kg and glycopyrrolate 5 µg/kg, and then trachea was extubated (defined as end of surgery), when the patient was awake.

Local anaesthetic solution for blocks was prepared in the form of bupivacaine 0.5% with epinephrine 1:200,000. The injection was given in unlabeled syringes prepared by an anaesthesiologist not involved in the patient's care or pain assessment. The specific treatment given was unknown to the patient, anaesthesiologist, surgeon or the nurse in charge of pain assessment.

After induction of general anaesthesia and before surgery, patients were randomly assigned into 3 equal groups using randomized numbers generated by a random number function in a computer spread sheet, resulted in a list of 36 assigned to patients receiving one of each three groups regimens;

**Group A:** received (BSCBs) by using a-23-gauge, short beveled needle (Pale, Top, Japan) inserted at midpoint of the lateral border of the sternocleidomastoid muscle. After negative aspiration, 10 ml the prepared solution was injected in four directions (2.5 ml in each direction) to block the main branches (lesser occipital, greater auricular, transverse cervical, and supraclavicular nerves) of the plexus.

**Group B:** After receiving (BSCBs), bilateral deep cervical plexus block (BDCBs), was performed according to a technique modified from that of Winnie et al\(^{(9)}\). The same needle was inserted behind the lateral border of the sternocleidomastoid muscle, 3 cm distal to the mastoid process. After negative aspiration for blood, 5 ml the prepared solution was injected in each side.

**Group C:** Did not receive any block after induction of general anaesthesia (controlled group).

On admission to the Post Anaesthesia Care Unit (PACU), where patients stayed for 2 hours, a nurse trained in acute pain service department interviewed them. Pain assessment was done on admission and discharge from the PACU (after 2 hours) and every 4 hours until 24 hours after the end of surgery. Pain intensity was evaluated with a horizontal VAS consisting of a line going from left (score 0; no pain) to right (score 10; maximal pain).
Postoperative pain management was standardized as follows. Peralgan (1g IVI over 20 minutes) was given every 6 hours during the first 24 hours. In PACU, 2 mg morphine IV was repeated every 6 minutes until the VAS was lower than 4; if IV morphine titration reached 6 mg or more, the patient received 5mg morphine subcutaneously before leaving the PACU. On the ward, the patient's VAS score was evaluated every 4 h by a nurse; if the pain score was 4 or higher, 5 mg morphine was administered subcutaneously.

The main outcomes were the number of patients who did not require morphine, total morphine requirements and pain scores in the 24 h after surgery.

Assuming that (BSCBs) would reduce the dose of intra- and postoperative narcotics by 50%, the number of patients required in each group to observe such reduction was at least 10 with (alpha) = 0.08. Continuous parametric variables are reported as mean ± SD and were analyzed with analysis of variance. Tukey's tests were used for post hoc comparison. The normal distribution of the data was assessed with the Kolmogorov-Smirnov test. Categorical variables were analyzed with (chi) 2 tests, with continuity correction if appropriate. Non-parametric data were compared by using the Kruskal-Wallis test. A value of $p < 0.05$ was considered significant.

**RESULTS**

There was no significant difference among the three studied groups as regard their demographic characteristics and surgical data (Table I).

| Table I: - Patients' demographic data and surgical characteristics (Values are mean ± SD). |
|------------------------------------------|------------------------------------------|------------------------------------------|
| Group A (n = 12)                         | Group B (n = 12)                         | Group C (n = 12)                         |
| Weight(kg)                               | 71±12                                   | 70±18                                   | 68±15                                   |
| Height(cm)                               | 159±7                                   | 164±8                                   | 165±7                                   |
| Age(yr)                                  | 50±10                                   | 48±12                                   | 47±10                                   |
| Male/Female ratio                        | 3/9                                     | 2/10                                    | 3/9                                     |
| Multinodular Goiter                      | 4                                       | 3                                       | 3                                       |
| Graves' disease                          | 0                                       | 1                                       | 0                                       |
| Thyroid cancer                           | 1                                       | 0                                       | 1                                       |
| Duration of surgery                      | 98±34                                   | 104±24                                  | 100±36                                  |

$P \leq 0.05$

Group A : Patients received bilateral superficial cervical plexus block.

Group B : Patients received bilateral superficial and deep cervical plexus block.

Group C : Control group with no regional block.

**Table II: Intra and Post – operative opioid consumption.**

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**DISCUSSION**

The results of this study can be discussed according to its results into 2 main parts; The first part, which was expected, is the superiority of giving regional block in the form of BSCBs alone or combined with BDCBs compared to general anaesthesia alone without any block as regards its opioid saving strategy and lower VAS scores both in PACU and in the ward 24 hours after surgery. In agreement with this part of results, Diedonne et al([6]), showed the analgesic advantage of BSCBs administered immediately after thyroid surgery. In their study, 45% of the patients did not require opioid analgesics in the PACU, while 34% did not require opiate analgesics during the first 24 hours after surgery. In our study which used comparable pain protocol, 41.7% and 50% of patients with BSCBs and combined with BDCBs, respectively, did not require any analgesic in the PACU, while 33.3% of the patients in both groups, did not require morphine during the 24 hrs after surgery.

In our study, the morphine requirements in both active block groups was 50% less than the controlled group in the PACU and around 60%, less in the ward, 24 hours
after surgery. These results come in agreement with previous studies\(^\text{6,7}\), although opioid saving strategy of such regional blocks was disappointing in relation to other surgeries like herniorrhaphy\(^\text{8}\), the results can be better obtained with using other "cocktails" for blocks including local anesthetics and other additives\(^\text{9}\) to solve the main limitation of relatively short duration of action of the administered local anesthetics and its peak plasma concentrations that might occasionally result from injection of higher doses in a highly vascularized area.

Gozal et al\(^\text{4}\), infiltrated the cervical incision with 10 ml of bupivacaine 0.5% and found that only 30% of patients required morphine when the wound was infiltrated. Lower percentages of their results may be appointed to their different study design as well as pain assessment and pain protocol.

The second part of our results, which was unexpected, is that there was no significant added analgesic or opioid saving advantage for BDCBs when combined with BSCBs. The technique of combined superficial and deep cervical blocks was initially developed to avoid general anaesthesia in carotid endarterectomy\(^\text{9}\) then it was used successfully to perform thyroidectomy during light sedation\(^\text{1,10}\). Deep cervical block plexus block is technically more difficult to perform and carries more serious complications than superficial cervical plexus block. Its complications include injection in the epidural, subarachnoid, or vertebral artery, but the most common complication is phrenic nerve palsy\(^\text{11}\). When deep cervical block is unilateral, phrenic nerve palsy is well tolerated with normal respiratory function\(^\text{11}\). In the present study, BDCBs were performed under general anaesthesia, which is not a recommended routine clinical practice, as this renders parathesia undetectable and masks signs of intravascular injection. In case of bilateral phrenic nerve palsy and epidural or intrathecal injections, major respiratory distress would have occurred, the treatment is mechanical ventilation till resolving\(^\text{11}\).

Fortunately, no patient had such a complication in our study. This may be due to the single-injection technique used instead of the classical three-injection technique, and also a smaller volume of local anesthetic (5ml), in comparison to other studies\(^\text{12,13}\).

In this study, BDSBs did not add analgesic or opioid saving benefits to patients with BSCBs. This came in contrast to other studies\(^\text{6,7}\). Aunac and his colleagues\(^\text{7}\), added clonidine 7.5µg/ml to ropivacaine 0.5% in the local anaesthetic solution for his block technique. In addition they gave clonidine IV 4 µg/kg over 15 minutes to all patients. Systemic clonidine is known to prolong and potentiate the local anesthetic induced sensory block\(^\text{14}\), moreover, clonidine itself is known to have a local anaesthetic effect\(^\text{15}\).

Herbland et al\(^\text{16}\), concluded that BSCBs with 0.75% ropivacaine administered before or after surgery did not improve postoperative analgesia after total thyroidectomy. They explained that by the unique pharmacokinetics of ropivacaine and the highly vascular surgical field.

Dieudonne et al\(^\text{6}\), showed that although postthyroidectomy pain perception likely includes many components linked to the deep and superficial layers of the wound, intra-operative neck position and wound drainage, the "superficial" component in the major pain source for such surgeries.

In conclusion, bilateral superficial cervical plexus block alone is an effective and safe technique to reduce analgesic requirements during and after thyroid surgery.

**REFERENCES**


