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**Research Article**

# Efficacy of unilateral combined (superficial and deep) cervical plexus block as a preemptive analgesia for unilateral neck dissection surgery

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**KEYWORDS**

Cervical plexus block;
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**Abstract** *Objectives:* The objectives of this study were designed to evaluate the intra- and postoperative analgesic efficacy of unilateral superficial and deep cervical plexus block for unilateral neck dissection surgery.

*Patients and methods:* Twenty eight patients were randomly assigned into two groups to receive either saline (control group) or bupivacaine (study group), hemodynamic monitoring. Bispectral index (BIS) monitor and MAC of isoflurane were recorded. Postoperative visual analogue score were recorded, operative time and postoperative first time to take analgesic were recorded.

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*Results:* Compared to the control group, patients received bupivacaine for unilateral superficial and deep cervical plexus block showed lower intraoperative isoflurane concentration and bispectral index, decreased postoperative visual analogue score, longer duration of analgesia, decreased plasma cortisol level. No patients developed adverse effects.

*Conclusion:* Unilateral combined superficial and deep cervical plexus block is an effective technique to reduce intraoperative anesthetics and reduce postoperative analgesic requirements in patients undergoing unilateral block neck dissection surgery without any adverse effects.



## 1. Introduction

Neck dissection is a surgical procedure that is used to control neck lymph node metastasis from tumors which commonly originate from the oral cavity, oropharynx, tongue, nasopharynx, hypopharynx and larynx, thyroid, parotid and posterior scalp [1].

Regional blockages are frequently used in cervical region whether as a single procedure or associated with sedation or general anesthesia.

The use of regional anesthesia in combination with general anesthesia may lighten the level of general anesthesia required, provide prolonged postoperative analgesia and reduce the requirements for opioid analgesics [2].

We hypothesized that the unilateral superficial and deep cervical plexus block will reduce the intraoperative anesthetic requirements and prolong the postoperative analgesia.

The aim of this study is to evaluate the intra- and postoperative analgesic efficacy of unilateral superficial and deep cervical plexus block for unilateral neck dissection surgery.

## 2. Patients and methods

After written informed consent and local ethics committee approval, this prospective – randomized – double blinded study was done in patients with (ASA I, II) aged from (50–60 years) scheduled for unilateral neck dissection under general anesthesia.

Exclusion criteria include history of allergy to the drugs used, local sepsis, bleeding disorder, diaphragmatic motion abnormality, inability to understand the study protocol or pain scale and patients under medications that would influence autonomic or cardiovascular responses to the surgery.

All patients were instructed the day before surgery about the study protocol and the use of visual analogue scale (VAS).

All patients were premedicated with midazolam 15 mg orally thirty min before surgery. On arrival into the operating room, standard monitoring was done including systolic blood pressure, diastolic blood pressure, heart rate and oxygen saturation then all patients underwent general anesthesia with I. V fentanyl 2 μg/kg, propofol 2 mg/kg, atracurium 0.4 mg/kg was used for tracheal intubation, after anesthesia was induced, the patients were randomly assigned (using computer software generated randomization code in closed envelope) into two groups to receive either saline (control group) or bupivacaine (study group) in the unilateral combined cervical plexus block (superficial and deep) which was done by anesthesiologist not aware with the study solutions and randomization, another anesthesiologist was involved in patientś data collection.

The combined cervical plexus block was initiated by a deep block using a single injection technique at the C3 vertebral level. After palpating the transverse process (next to the posterior border of sternocleidomastoid muscle) and local skin infiltration with 2 mL of 2% lidocaine, a 24-gauge needle was introduced perpendicularly in a slightly caudal direction until the transverse process was located in the depth of 2–3 cm followed by an injection of 0.5% bupivacaine after negative aspiration for blood and/or cerebrospinal fluid. Superficial element of the block was done using a 20-gauge needle which was introduced into the skin (at the midpoint of the posterior border of the sternocleidomastoid muscle, and 0.5% bupivacaine was injected along the posterior border in both cranial and caudal directions subcutaneously and superficial and deep to the fascia of the muscle. A ''fan'' injection was also performed subcutaneously from the posterior border of sternocleidomastoid toward the midline of the neck [3]. The total dose of (0.5%) bupivacaine used was designed to be 1.4 mg/kg, approximately one third of the total dose used was placed deep, and two thirds of the dose was placed superficially and the dose adjusted according to the body weight (Figure 1).

Maintenance of anesthesia was achieved with mixture of isoflurane and oxygen and atracurium increments of 0.1–0.2 mg/kg. We monitored the BIS changes with target of 40–50 up to 60 using titration of isoflurane. Bolus doses of fentanyl 1 μg/kg were given if systolic arterial blood pressure SAP) and/or HR increased by more than 20% above baseline (for more than 5 min in response to a surgical stimulus).

Intraoperative monitoring included (non-invasive blood pressure, 3-lead ECG, pulse oximetry, end-tidal CO2, BIS monitor strip was placed on the forehead before induction of anesthesia and MAC of isoflurane, all were monitored throughout the operation.

Systolic blood pressure, diastolic blood pressure and heart rate were recorded after induction of anesthesia, every 5 min during surgery (the values during every hour of surgery were averaged to give a single mean value) and at 1 h after recovery.

At the completion of surgery, isoflurane was discontinued and residual neuromuscular block was antagonized with neostigmine 50 μg/kg and atropine 20 μg/kg.

Duration of surgery and the time from completion of surgery until the first analgesic dose requirements were recorded, visual analog score were recorded at (1 h, 2 h, 6 h, 12 h, 24 h) postoperatively.

Postoperative analgesia was treated with IV ketorolac (30 mg) per dose every 8 h to achieve a visual analog score $\leqslant 4$, tramadol 50 mg i.v was used as a rescue analgesic if the patients continued to suffer pain after ketorolac administration.

Postoperative monitoring of side effects related to the cervical plexus block were recorded (such as vertebral artery, subarachnoid, or epidural injections and phrenic nerve palsy).

Laboratory monitoring of stress response to surgery was done at basal (before induction of anesthesia), before the

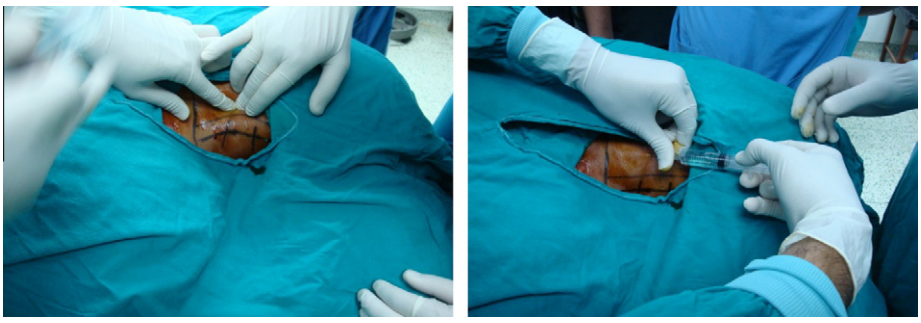


**Figure 1** Unilateral combined superficial and deep cervical block in unilateral block neck dissection surgery.

block, 1 h after the block and 1 h after recovery, blood samples were collected by venipuncture into dry clean tubes and investigated for cortisol level, serum was separated, alequated and stored at (−20 °C) until analysis, cortisol was assayed by chemiluminescence immunoassay using immulite 1 Siemens (S/NO-H2 737, production no, 030001-04, p/n 650024-04).

### *2.1. Statistical analysis*

The statistical analysis of data was done by using SPSS (SPSS, Inc., Chicago, IL). Program (Statistical Package for Social Science version 16). To test the normality of data distribution K–S (Kolmogorov–Smirnov) test was done, the description of data done in form of mean (±) SD for quantitative data, frequency & proportion for Qualitative data. The analysis of the data was done to test statistical significant difference between groups. For quantitative date independent *t*-test was used to compared between two groups. Chi square test was used
for qualitative data. *P* value less than 0.05 was considered significant.

Calculated sample size is 12 patients for each group + 10% increase to compensate for dropped patients during study. So, a total number of 14 patients was chosen in each group.

## 3. Results

Patients age, sex, height, weight and duration of surgery showed that there were no significant difference between two groups (Table 1).

Basal values of systolic blood pressure, diastolic blood pressure and heart rate, showed no significant differences between the study group and the control group, but their values during 1st h of surgery, 2nd h, 3rd h, above the 3rd h of surgery and after recovery showed significant decrease in the study group in comparison to the control group with the *p*-value (0.000) [Graphs 1 and 2].

Intraoperative additional dose of fentanyl was given to all cases of the control group and no one in the study group need additional dose of fentanyl.

During the whole surgery the MAC of isoflurane was significantly decreased in the study group in comparison to the control group with the *p*-value (0.000) [Table 2].

BIS also was significantly lower in the study group in comparison to the control group during the whole surgery with ($p = 0.000$) [Table 2].

As regard plasma cortisol, there was no significant difference (in the basal values and values before the block) in both the study and the control group, but plasma cortisol in the control group rapidly increased in comparison to the study group (during surgery and after recovery) over the basal values, however in the study group plasma cortisol showed a significant reduction during surgery and after recovery with ($p = 0.000$) [Table 3].

Post operative pain assessment by visual analogue score showed significantly lower at 1 h,2 h,6 h, 12 h, and 24 h postoperatively in the study group in comparison to the control group with *p*-value (0.000) [Graph 3], postoperative time to take analgesia was significantly prolonged in the study group in comparison to the control group [Table 3].

**Table 1** Patient's characteristics and duration of surgery (min).

| Variable | Control ($n = 14$) | Study ($n = 14$) | *p*-Value |
|---|---|---|---|
| Male | 11 (78.6%) | 11 (78.6%) | 1.000 |
| Female | 3 (21.4%) | 3 (21.4%) | |
| Age (years) | 55.50 ± 3.13 | 55.35 ± 3.43 | 0.909 |
| Weight (kg) | 62.14 ± 3.59 | 62.28 ± 3.85 | 0.920 |
| Height (cm) | 168.07 ± 2.89 | 167.00 ± 2.96 | 0.342 |
| Duration of surgery (min) | 283.50 ± 33.03 | 289.92 ± 38.58 | 0.640 |

## 4. Discussion

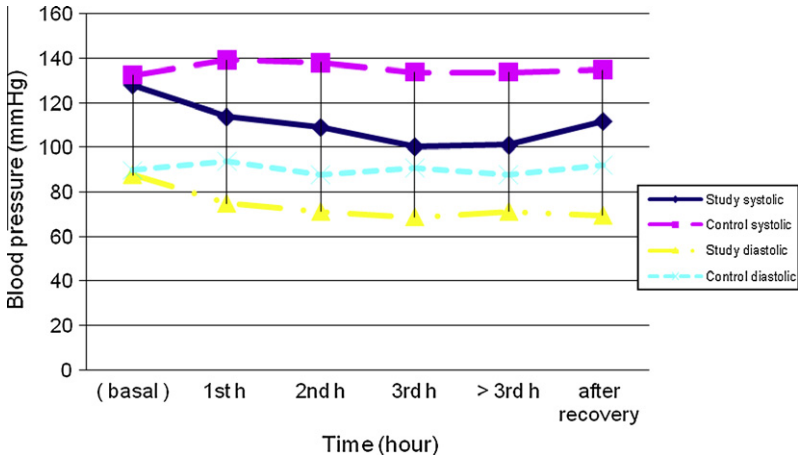
Combined superficial and deep cervical plexus block is a technique that was initially developed to avoid general anesthesia for carotid endarterectomy [4], also It has been successfully used to perform thyroidectomy during light sedation [5,6].

The main finding of the current study is that unilateral combined (superficial and deep) cervical plexus block decreases the intraoperative anesthetic requirements and decreases postoperative analgesic consumption without any adverse effects.

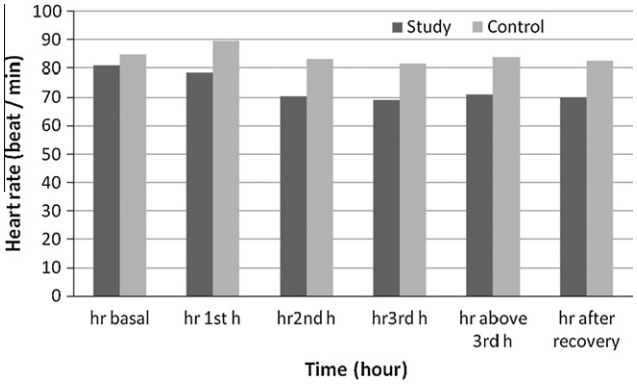
Deep cervical plexus block is technically more difficult and associated with more serious complications (such as vertebral artery, subarachnoid, or epidural injections and phrenic nerve palsy) than superficial cervical plexus block however, the most common complication is the phrenic nerve palsy which well tolerated when the block is unilateral [7].

In the present study, no patient had complication of phrenic nerve palsy, this may be due to the single-injection technique used.

In parallel with the result of our study on intraoperative anesthetic requirements and postoperative analgesic requirements. Aunac et al. [8] showed that bilateral superficial




**Graph 1** Systolic and diastolic blood pressure, significant reduction in systolic blood pressure and diastolic blood pressure in the study group (basal: systolic and diastolic blood pressure at basal value; 1st h: systolic and diastolic blood pressure at first hour of surgery; 2nd h: systolic and diastolic blood pressure at second hour of surgery; 3rd h: systolic and diastolic blood pressure at third hour of surgery; > 3rd h: systolic and diastolic blood pressure above the third hour; after recovery: systolic and diastolic blood pressure after recovery).




**Graph 2** hr (Heart rate, beat/min), significant reduction in the intraoperative heart rate and after recovery in the study group (hr basal: heart rate at basal value; hr1st h: heart rate at first hour of surgery; hr2nd h: heart rate at second hour of surgery; hr3rd h: heart rate at third hour of surgery; Above3rd h: heart rate at hours above the third hour; hr after recovery: heart rate after recovery).

and deep cervical plexus block performed with 0.5% plain ropivacaine reduced intraoperative anesthetic and analgesic requirements in patients undergoing thyroidectomy. They also reported that postoperative analgesics were significantly reduced during the first 24 h after surgery.

Dieudonne et al. [9] reported that bilateral superficial cervical block administered immediately after thyroid surgery reduced the analgesic requirements.

On the other studies such as Herbland et al. [10] reported that BSCBs (bilateral superficial cervical blocks) with 0.75% ropivacaine administered before or after surgery did not improve postoperative analgesia after total thyroidectomy, they used ropivacaine for the block and they explained that by the unique pharmacokinetics of ropivacaine and the highly vascular surgical field.

Pintaric et al. [11] reported that adding deep CPB (cervical plexus block) to the superficial does not increase the efficacy and success rate of CPB while providing similar onset time of surgical block, similar consumption of intraoperative rescue opioid analgesics and similar patient satisfaction.

Ivanec et al. [12] reported that combined block provided a slightly better analgesia during surgery, which was clinically irrelevant, also there were no differences in postoperative analgesia and hemodynamic stability.

Moreover, Pandit et al. [3] demonstrated that the dye injected above the prevertebral layer of the DCF (deep cervical fascia) penetrates through the ''pores'' where the nerves pierce

**Table 2** Bispectral index (BIS), minimum alveolar concentration (MAC) of isoflurane.

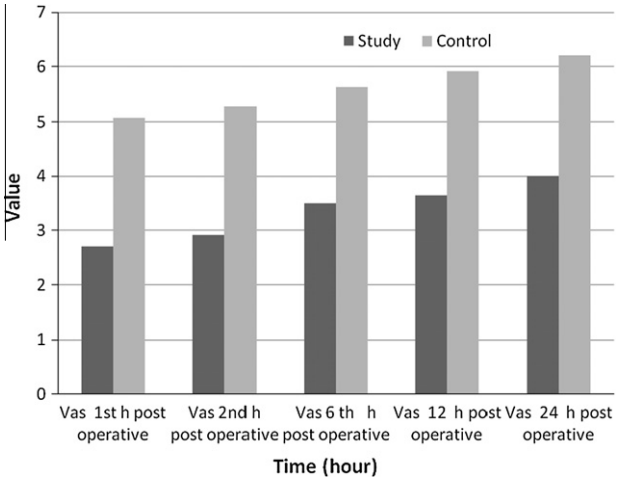
| Variable | Control ($n$ = 14) | Study ($n$ = 14) | $p$-Value |
|---|---|---|---|
| BIS 1st h of surgery | 49.14 ± 3.05 | 44.28 ± 1.48 | 0.000* |
| BIS 2nd h of surgery | 48.71 ± 2.70 | 43.85 ± 1.29 | 0.000* |
| Bis 3rd h of surgery | 49.92 ± 3.49 | 45.28 ± 3.19 | 0.001* |
| BIS above 3rd h of surgery | 48.78 ± 2.80 | 44.42 ± 1.01 | 0.000* |
| MAC 1st h of surgery | 1.75 ± 0.25 | 0.68 ± 0.10 | 0.000* |
| MAC 2nd h of surgery | 1.47 ± 0.26 | 0.72 ± 0.09 | 0.000* |
| MAC 3rd h of surgery | 1.43 ± 0.28 | 0.65 ± 0.12 | 0.000* |
| MAC above 3rd h of surgery | 1.53 ± 0.22 | 0.74 ± 0.07 | 0.000* |

BIS: Bispectral index.
MAC: minimum alveolar concentration of isofluran.
* Significant lower BIS and MAC of isoflurane in the study group than the control group.

**Table 3** Plasma cortisol level (μg/dl) and first time to take analgesia (h).

| Variable | Control ($n$ = 14) | Study ($n$ = 14) | $p$-Value |
|---|---|---|---|
| Cortisol (basal) | 34.06 ± 2.39 | 32.35 ± 4.20 | 0.198 |
| Cortisol (before block) | 34.73 ± 2.37 | 34.69 ± 2.99 | 0.971 |
| Cortisol (after block) | 47.62 ± 2.76 | 22.02 ± 4.45 | 0.000** |
| Cortisol (after recovery) | 50.92 ± 1.91 | 20.85 ± 10.00 | 0.000** |
| First analgesic request postoperative (h) | 0.85 ± 0.23 | 13.00 ± 5.18 | 0.000* |

* Significant decreased first time of analgesic request postoperative in the study group than the control group.
** Significant decreased plasma cortisol in the study group than the control group after the block and after recovery.




**Graph 3** Postoperative visual analogue score), significant reduction in vas in the study group (Vas: visual analogue score).

the fascia, ending in the deep cervical space. The deep and the superficial spaces thus virtually act as a single space.

Recurrent laryngeal nerve palsy secondary to the diffusion of local anesthetic has been well described after deep CPB in the study of Harris and Benveniste [13] in the present study, no patients reported vocal cord dysfunction or hoarseness.

The present study showed that the hemodynamic response to surgical stimulation was markedly attenuated in the study group and the plasma cortisol level decreased with unilateral combined (superficial and deep) cervical plexus block with bupivacaine.

The stress response to surgery is characterized by hormonal changes initiated by sympathetic activation and enhanced secretion of hypothalamic–pituitary–adrenal axis, the magnitude and duration of the response is related to the extent of surgical trauma, cortisol secretion from the adrenal cortex increase rapidly with the start of surgery due to ACTH stimulation which leads to increase plasma cortisol level from the basal value (around 400 nmol l) to a maximum level at about 4–6 h and reach more than 1500 nmol l, this hormonal change can be modified by the anesthetic intervention, regional anesthesia with local anesthetic agents inhibits the stress response to surgery [14].

## 5. Conclusion

The present study concluded that unilateral combined superficial and deep cervical plexus block is an effective technique to reduce the intraoperative anesthetic requirements and also it reduces the postoperative analgesic requirements in patients undergoing unilateral block neck dissection surgery under general anesthesia without any adverse effects.

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