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Effect of combined superficial cervical plexus block with intermediate cervical plexus block on intraoperative opioid requirement and postoperative analgesia for thyroid surgery

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Abstract: Background and Aim: Bilateral superficial cervical plexus block provides adequate analgesia in the neck region for thyroid surgery. Intermediate cervical plexus block can block all four cutaneous branches of the cervical plexus and sensory/ motor branches of the cervical plexus supplying the sternocleidomastoid muscle simultaneously so that provides adequate analgesia and anesthesia for neck surgeries that involve manipulation or resection of the sternocleidomastoid muscle. Along with general anesthesia, bilateral superficial cervical plexus block with intermediate cervical plexus block was given to reduce intraoperative opioid requirement and increase the duration of postoperative analgesia. **Material and Methods:** A total of 56 patients aged between 18 to 65 years of either sex, ASA I and II, undergoing elective thyroid surgery were randomly allocated in two groups. Group S receives bilateral superficial and intermediate cervical plexus block with Inj. Ropivacaine 0.375% before induction of general anesthesia, and Group C receives no block. In both groups, intraoperative opioid requirement, intraoperative hemodynamics, time of rescue analgesia, total no. of rescue analgesic in 24 hours, total duration of analgesia, and complications were noted. **Results:** Group S (25 ± 0 micrograms) had less mean fentanyl requirement intraoperatively than group C (35 ± 14.43 micrograms). Intraoperative hemodynamics were better in Group S compared to Group C. Total duration of analgesia was prolonged in group S (24.57 ± 4.72 hours) than in Group C (4.57 ± 2.10 hours). Total no. of rescue analgesic was reduced in group S (8 patients (28.57%)- 1 dose and 20 patients (71.42%)- no analgesic) as compared to group C (7 patients (25%)- 3 doses, 20 patients (71.42%)- 2 doses, one patient (3.57%)- one dose). **Conclusion:** Combination of bilateral superficial cervical plexus block with intermediate cervical plexus block reduces intraoperative opioid requirement and increases postoperative analgesia with better intraoperative hemodynamic variables and fewer side effects.

Keywords: Cervical plexus block; Analgesia; Opioids; thyroidectomy

1. Introduction

Surgery or anesthesia associated with hemodynamic stress and abnormal heart rate and blood pressure changes occur throughout the perioperative period. The cause for such change is multifactorial. Regardless of the type of surgery and anesthesia, the predominant factor that produces this adverse change is pain. When general anesthesia is employed for surgery, the hemodynamic changes are intense during intubation, intraoperative stress, and extubation. To attenuate these unwanted stress responses, various techniques are employed: the administration of parenteral opioids, intravenous lidocaine, beta-blockers, and vasodilators like nitroglycerine and local anesthetic techniques like field block, nerve block, plexus block, and neuraxial block. Simple analgesics such as paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs)

were found insufficient to manage pain after thyroidectomy [1,2]. In our study, bilateral superficial and intermediate cervical plexus block was given with 0.375% Ropivacaine prior to skin incision and evaluation of intraoperative additional opioid requirement, postoperative analgesia, and intraoperative hemodynamic parameters for thyroid surgeries in addition to general anesthesia.

2. Material and Methods

After institutional ethical committee approval, a prospective randomized single-blind controlled trial of bilateral superficial with intermediate cervical plexus block for thyroid surgery was carried out in group S (study) and group C (control), of 28 patients each. Randomization was done with the use of sealed envelopes. Odd numbers indicated group S and even numbers indicated group C. After informed written consent, patients aged 18 to 65 years with ASA grades 1 and 2 who were posted for elective thyroid surgery were included in the study. All the patients underwent a thorough pre-anesthetic check-up, including history taking, general examination, systemic examination, and local examination. Routine investigations like hemogram, blood sugar, blood urea, serum creatinine, chest X-ray, ECG, Thyroid function test, and Indirect Laryngoscopy were done for all patients. All patients were taught about the pain scale regarding the Numerical Rating Scale during pre-operative visits. Informed consent was obtained from all patients for the block procedure and enrolment in the study. Benefits and likely complications were explained to the patient and caretaker in understandable language. Each patient was randomly allocated to one of two groups of 28 patients; each group S-Received bilateral superficial and intermediate cervical plexus block, and group No block was given in this group. Each patient was visited pre-operatively, investigated, the procedure explained, written informed consent obtained, and kept nil by mouth after 10 PM. Intravenous access, standard monitor, i.e., pulse oximetry, electrocardiogram, non-invasive blood pressure, ETCo2, BIS applied. Premedication was given to the patient as Inj. Glycopyrrolate 4mcg/kg, Inj. Ondansetron 0.1 mg/kg, Inj. Fentanyl 1ug/kg., Inj. Midazolam 0.2 mg/kg. The superficial cervical plexus was blocked at the midpoint of the posterior border of the sternocleidomastoid muscle bilaterally. A skin wheal was made at this point. A 23-gauge, 4-cm needle is advanced, injecting 7.5 mL of solution along the posterior border and medial surface of the sternocleidomastoid muscle subcutaneously, perpendicularly, cephalad, caudad in a fan fashion. The intermediate cervical plexus was blocked using a simple LOR technique. The landmark for this block is the same as that for the superficial plexus block, i.e., the midpoint of the posterior border of the sternocleidomastoid muscle. A 22G 50mm insulated stimulex needle is advanced at the midpoint of SCM, keeping the needle almost perpendicular to the skin. Once the needle tip is through the skin, resistance is felt over the investing fascia of the neck; feel for a bounce and then a "pop" as the needle tip pierces the fascia. 10ml of 0.375 % of Ropivacaine was injected incrementally. After giving the block, the onset of sensory block and development of any side effects are evaluated every 5 minutes for the first 15 minutes. After 15 minutes, General anesthesia was given. Preoxygenation with 100% oxygen for 5 minutes. Inj. Thiopental 6 mg/kg I.V. Inj. Succinylcholine 1.5 mg/kg I.V. 7.0 mm i.d. number reinforced armor endotracheal tube for female and 8.0 i.d. number reinforced armor endotracheal tube for male was inserted orally through direct laryngoscopy with McIntosh blade and bilateral air entry checked, and the cuff was inflated with air till leak of gas stopped which was assessed by stethoscope over the neck. Maintenance was done with O2 + sevoflurane +N2O + Inj. Vecuronium + IPPV mode of ventilation. A Bolus of fentanyl 25 ug was given if the heart rate increases by more than 20% above baseline and when mean arterial blood pressure increased by ten mmHg. After completion of surgery, sevoflurane was discontinued, and Inj antagonized neuromuscular blockade. Glycopyrrolate 8 mcg/kg and Inj. Neostigmine 0.05 mg/kg. Postoperative pain was assessed with a numerical rating scale (0-10). 0-no pain, 1-3-mild pain, 4-6-moderate pain, 7-10-severe pain. At the score of 4, diclofenac sodium I.M. (1.5mg/kg) was injected. At the end of the surgery, the total duration was noted. The time of rescue analgesic was noted, and the total duration of analgesia was noted, i.e., from the onset of sensory blockade to when the patient complained of pain at the surgical site. The patient was observed for adverse effects such as hypersensitivity to local anesthetics, intravascular injection, nerve injury, systemic toxicity of local anesthetics, the rarely neuraxial spread of local anesthetics, blockade of brachial plexus, and phrenic nerve block.

Statistical analysis

Parametric data was analyzed using the student's unpaired t-test for the onset duration of sensory block. Non-parametric data analyzed by Chi-square test. A p-value <0.05 is considered significant & p-value <0.001 is considered highly significant. Data were expressed as mean± S.D. or % as appropriate.

3. Results

Demographic data, such as age, weight, height, and duration of surgery, were comparable. Total intraoperative analgesic, i.e, fentanyl consumption in group S, was 25 ± 0 micrograms, and in Group C was 35 ± 14.43 micrograms. The difference was highly significant ($p < 0.001$) both clinically and statistically. The mean NRS score at 1 hr and 8 hr postoperatively in group S was 0.17 ± 0.39 and 0.5 ± 1.03, and for group C was 4.28 ± 1.11 and 3.35 ± 2.00 respectively and was highly significant (p<0.001). A total number of analgesic (Inj. Diclofenac) doses required postoperatively in Group S was eight patients (28.57%) required 1 dose and 20 patients (71.42%) required no analgesic; in Group C 7 patients (25%) required three doses, 20 patients (71.42%) required two doses, one patient (3.57%) required one dose postoperatively. The mean no. of the dose required was 0.28 ± 0.46, and in Group C was 2.21 ± 0.49, which was highly significant $(p < 0.01)$. The total duration of analgesia in Group S was 24.57 ± 4.72 hours, and in Group C was 4.57 ± 2.10 hours and was highly significant $(p < 0.001)$. In Group S, intraoperative nausea and vomiting in 2 patients, accidental brachial plexus block in 1 patient, and postoperatively hoarseness of voice in 3 patients, and in Group C, nausea and vomiting in 3 patients were observed.

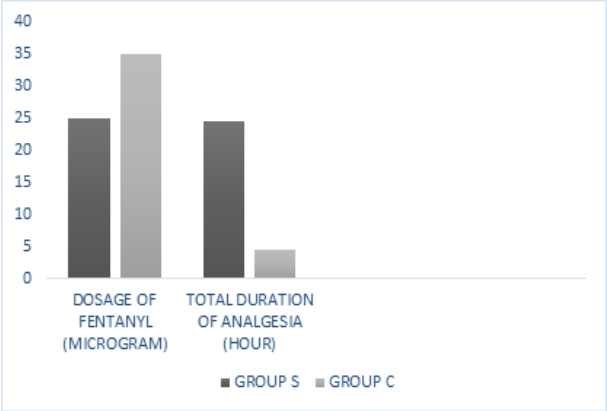

Figure 1. changes in hemodynamic parameters at time interval

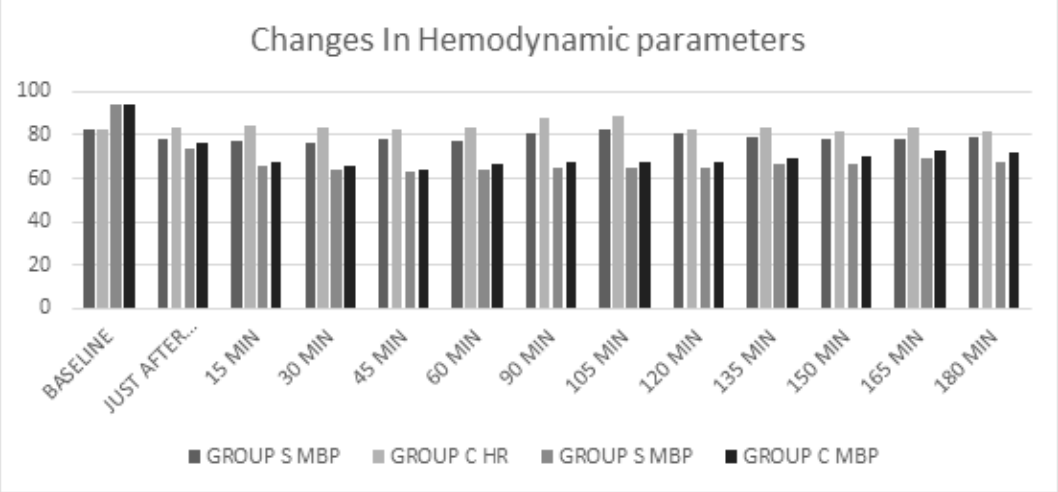

Figure 2. shows comparison of dosage of fentanyl and total duration of analgesia in group S and group C

4. Discussion

Postoperative pain after thyroid surgery is important, especially in early postoperative hours. Different medications, such as opioids and non-steroidal anti-inflammatory agents, have been used to control postoperative pain. Different techniques have been assessed, such as infiltration using local anesthetics and cervical plexus blocks. We studied superficial and intermediate cervical plexus block for the reduction of intraoperative opioid requirement and postoperative analgesia for thyroid surgery. It is effective and safe and reduces opioid requirements and associated complications and costs. Superficial cervical plexus blockade provides effective analgesia in the neck region, but its ineffectiveness has also been reported [3,4]. In their cadaveric study, Ramachandran SK^4, Pandit JJ, and colleagues [5] demonstrated that injections placed below the investing fascia of the neck diffuse into the deep space, whereas injections placed subcutaneously did not. They termed the injection deep to the investing layer of the neck as the 'intermediate' cervical plexus block. So, along with a superficial cervical plexus block, an intermediate cervical plexus block was given to assess its efficacy. Deep cervical plexus block is difficult to perform and has many complications, so it was avoided. In our study, we observed that, in group S, the intraoperative mean fentanyl requirement was 25 ± 0 microgram as compared to group C 35 ± 14.43 microgram, as well as a reduction in postoperative pain scores, were reported in the study group. The total duration of analgesia was significantly prolonged in the study group (24.57 ± 4.72 hours) compared to the control group (4.57 ± 2.10 hours). In a similar study, Meski Y et al. [6] observed a reduction in per-operative remifentanil requirement after intermediate cervical plexus block in thyroid surgery. Dioudanne and Colleagues [7] also found a reduction in postoperative opioid requirement and prolonged postoperative analgesia after bilateral superficial cervical plexus block. G Andrieu et al. [8] found a reduction in postoperative nefopam requirement in total thyroidectomy after bilateral superficial cervical plexus block. Barone M et al. [9] found intermediate cervical plexus block effective and safe for carotid endarterectomy compared to deep cervical plexus block, which is challenging to perform and associated with many complications. Salwa Mohmmad et al. [10], Ming Lang Shih et al. [11], and Yophtahe B et al. [12] found prolonged postoperative analgesia. However, Alexandre Herbland et al. [3] did not find an analgesic effect after superficial cervical plexus block and reported its ineffectiveness. As well as Ramachandran SK^4 also found no difference in fentanyl requirement between intermediate cervical plexus block and subcutaneous infiltration of local anesthetics. Salwa Mohmmad et al. [10], G Andrieu [8], and Tais et al. [13] reported better hemodynamic stability in those patients who were given block. In our study, few patients reported nausea and vomiting, comparable to the control group. In 3 patients, hoarseness of voice, and in 1 patient, accidental brachial plexus block was reported. In similar studies, the incidence of nausea and vomiting was high in the control group as compared to the study group, which may be attributed to increased opioid dosages. In a study by Sophie Aunac and colleagues [14], three patients had nausea and vomiting, and in one patient, transient paraesthesia of the upper limb was reported.

5. Conclusion

As per our observation and results, we conclude that combination of Bilateral superficial with intermediate cervical plexus block for thyroid surgery reduces intraoperative opioid consumption, reduces postoperative analgesic requirement, and significantly improves postoperative analgesia along with better hemodynamic variables and less side effects.

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