

Bilateral Superficial Cervical Plexus Block Combined with General Anesthesia Administered in Thyroid Operations – A Randomised Controlled Trial

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Abstract

Background: Postoperative pain following thyroid surgery is usually moderate and is concentrated in the early postoperative period. Although multimodal analgesia is widely used, regional analgesic techniques such as bilateral superficial cervical plexus block (BSCPB) may provide additional opioid-sparing analgesia. Published randomized trials and meta-analyses have reported variable efficacy, partly related to differences in local anaesthetic, block technique, timing and background analgesic regimens.

Aim: To evaluate the effect of bilateral superficial cervical plexus block, when combined with general anaesthesia, on postoperative pain, duration of analgesia, rescue analgesic requirement, intraoperative haemodynamics, postoperative nausea and vomiting (PONV), operating time and hospital stay following thyroid operations.

Materials and Methods: This randomized controlled study included 30 patients. Fifteen patients received bilateral superficial cervical plexus block in addition to general anaesthesia (block group), while 15 received general anaesthesia without the block (no-block group). Demographic characteristics, ASA physical status, intraoperative systolic blood pressure and heart rate, operating time, visual analogue scale (VAS) scores at 1 and 4 hours, time to first rescue analgesia, PONV and hospital stay were analysed. Continuous variables were compared using Welch's t-test or Mann-Whitney U test as appropriate, while categorical variables were analysed using Fisher's exact test. A two-sided $P < 0.05$ was considered statistically significant.

Results: Postoperative pain was significantly lower in the block group at 1 hour [median VAS 4 (IQR 3–4) vs 6 (IQR 5–7), $P < 0.001$] and 4 hours [4 (4–5) vs 8 (7.5–9), $P < 0.001$]. VAS > 4 occurred in 13.3% versus 93.3% at 1 hour ($P < 0.001$) and 46.7% versus 100% at 4 hours ($P = 0.002$). Median time to rescue analgesia was significantly longer following BSCPB [280 (240–295) vs 60 (45–67.5) minutes, $P < 0.001$]. PONV and hospital stay did not differ significantly.

Conclusion: Addition of BSCPB to general anaesthesia was associated with substantially improved early postoperative analgesia and delayed requirement for rescue analgesia, without prolonging surgery or reducing hospital stay.

Keywords: Bilateral Superficial Cervical Plexus Block; Thyroidectomy; Postoperative Pain; Regional Anaesthesia; Rescue Analgesia; Visual Analogue Scale; General Anaesthesia.

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Introduction

Thyroid surgery is generally considered a relatively low-pain surgical procedure; nevertheless, a clinically important proportion of patients experience moderate pain during the first postoperative hours. Pain may result not only from the cervical incision and tissue dissection but also from tracheal intubation, cervical positioning, tissue retraction and inflammatory responses associated with surgery. Inadequate early analgesia

can delay mobilization, impair patient comfort and contribute to increased use of systemic analgesics. [1,2] Historically, opioid analgesics have been used for postoperative pain following thyroidectomy. However, opioid administration may be associated with nausea, vomiting, sedation, respiratory depression and delayed recovery. These considerations are particularly relevant in thyroid surgery because postoperative airway compromise

is an important concern. Consequently, contemporary perioperative practice increasingly emphasizes multimodal analgesia and opioid-sparing techniques. [3-5] Local anaesthetic infiltration of the thyroidectomy wound was one of the earliest regional approaches evaluated for postoperative analgesia. Gozal et al. demonstrated that bupivacaine wound infiltration reduced postoperative pain and opioid requirements compared with no infiltration. [6] Their findings supported the concept that blockade of sensory input from the operative field could improve post-thyroidectomy analgesia.

The superficial cervical plexus supplies cutaneous sensation to much of the anterior and lateral neck through the lesser occipital, great auricular, transverse cervical and supraclavicular nerves. Bilateral superficial cervical plexus block therefore provides a logical regional analgesic technique for thyroid operations.

The block is usually performed by deposition of local anaesthetic in the fascial plane superficial to the prevertebral fascia and deep or adjacent to the posterior border of the sternocleidomastoid muscle. Compared with bilateral deep cervical plexus block, the superficial technique avoids intentional deep injection close to the phrenic and cervical sympathetic nerves and is consequently considered a less invasive regional technique. [7]

Early randomized trials produced conflicting results. Dieudonne et al. demonstrated reduced postoperative pain following bilateral superficial cervical plexus block performed after thyroid surgery. [8]

Conversely, Eti et al. found no significant reduction in total patient-controlled analgesic requirement when superficial cervical block with bupivacaine was compared with local infiltration or control. [9] Herbland et al. similarly reported that 0.75% ropivacaine administered before or after thyroid surgery did not prevent postoperative pain. [10] These differences suggested that efficacy could be influenced by the local anaesthetic concentration, volume, timing of administration, injection technique and background analgesic regimen.

Subsequent randomized studies have generally provided more supportive evidence. Andrieu et al. reported that bilateral superficial cervical plexus block using ropivacaine, with or without clonidine, reduced postoperative analgesic requirements and pain scores, with additional improvement in intraoperative analgesia when clonidine was added. [11]

Karthikeyan et al. also demonstrated reductions in intraoperative fentanyl requirement, postoperative morphine consumption and time to first analgesic administration following bupivacaine-based

BSCPb. [12] Other randomized studies have demonstrated reductions in postoperative pain and opioid consumption when BSCPb was combined with general anaesthesia. [13-16] The cumulative evidence has been evaluated in several systematic reviews. A meta-analysis of eight randomized trials involving 799 patients demonstrated significantly lower pain scores at both 6 and 24 hours following BSCPb. [17]

The subsequent systematic review by Mayhew et al., incorporating 14 randomized trials and 1,154 patients, reported reduced postoperative analgesic requirements, improved pain scores and longer time to first analgesic request, although no significant reduction in PONV was demonstrated. [18] More recently, Wilson et al. analysed 31 studies involving 2,273 patients and reported reductions in postoperative opioid consumption, rescue analgesic requirement and pain scores, together with a significant prolongation of analgesic duration. [19] A further systematic review involving 34 studies and 2,519 patients similarly reported substantial reductions in postoperative pain and rescue analgesic use. [20] Despite increasing evidence supporting BSCPb, variation remains between studies regarding technique, local anaesthetic, and timing of block and concomitant analgesic protocols. The present study was therefore undertaken to evaluate the effect of BSCPb combined with general anaesthesia.

Aim and Objectives

Primary Aim: To evaluate the effect of bilateral superficial cervical plexus block combined with general anaesthesia on early postoperative pain following thyroid operations.

Secondary Objectives

To compare between the block and no-block groups:

1. VAS pain scores at 1 and 4 hours after surgery.
2. Proportion of patients with clinically significant pain (VAS >4).
3. Time to first rescue analgesic requirement.
4. Change in VAS between 1 and 4 hours.
5. Intraoperative systolic blood pressure.
6. Intraoperative heart rate.
7. Operating time.
8. Incidence of PONV.
9. Duration of hospital stay.

Materials and Methods

Study Design: This was a randomized controlled comparative study evaluating patients undergoing thyroid operations under general anaesthesia. Fifteen patients were recorded in the bilateral superficial cervical plexus block group (B), while 15 patients were recorded in the no-block group

(NB). The study was analysed as a two-arm comparison.

The recorded baseline variables included:

- age;
- sex;
- ASA physical status.

The perioperative variables included:

- mean intraoperative systolic blood pressure;
- mean intraoperative heart rate;
- Operating time.

The postoperative variables included:

- VAS at 1 hour;
- VAS at 4 hours;
- clinically significant pain defined in the analysis as VAS >4;
- change in VAS from 1 to 4 hours;
- time to first rescue analgesia;
- PONV;
- Hospital stay.

Intervention and Comparator: Patients in the intervention group received bilateral superficial cervical plexus block in addition to general anaesthesia. Patients in the comparator group received general anaesthesia without the cervical plexus block.

Outcome Assessment: The principal postoperative outcome was pain intensity measured using the visual analogue scale. VAS values recorded at 1 and 4 hours were compared between groups. A VAS score >4 was considered clinically significant pain for the present analysis. Time to first rescue analgesia was recorded in minutes and was

analysed as an important indicator of the duration of analgesic benefit. PONV was analysed as a binary postoperative outcome. Hospital stay was analysed in days.

Statistical Analysis: Continuous variables were assessed according to their distribution. Normally distributed continuous variables were expressed as mean $\pm$ standard deviation and compared using Welch's independent-samples t-test. VAS scores and rescue analgesia time were expressed as median and interquartile range and compared using the Mann-Whitney U test because of their ordinal/discrete distribution and small sample size. Categorical variables were expressed as number and percentage. Fisher's exact test was used for categorical comparisons. For selected continuous outcomes, the between-group mean difference was calculated as the block-group value minus the no-block value, together with a 95% confidence interval. All tests were two-sided and $P < 0.05$ was considered statistically significant.

Results

A total of 30 patients were available for analysis, comprising 15 patients in the bilateral superficial cervical plexus block group and 15 patients in the no-block group. The demographic characteristics of the two groups were comparable. The mean age was 45.4 ± 8.3 years in the block group and 41.6 ± 6.6 years in the no-block group ($P = 0.175$). Female patients constituted 66.7% and 60.0% of the block and no-block groups, respectively ($P = 0.704$). ASA physical status was also similarly distributed, with ASA I in 40.0% and 33.3% and ASA II in 60.0% and 66.7% of patients in the block and no-block groups, respectively ($P = 0.704$) [Table-1].

Table 1: Demographic and baseline characteristics

Variable	Block (n=15)	No block (n=15)	P value
Age, years, mean $\pm$ SD	45.4 ± 8.3	41.6 ± 6.6	0.175
Female, n (%)	10 (66.7)	9 (60.0)	0.704
Male, n (%)	5 (33.3)	6 (40.0)	—
ASA PS I, n (%)	6 (40.0)	5 (33.3)	0.704
ASA PS II, n (%)	9 (60.0)	10 (66.7)	—

The recorded mean intraoperative systolic blood pressure was significantly lower in the block group compared with the no-block group (111.9 ± 5.5 vs 128.9 ± 6.2 mmHg, $P < 0.001$). Similarly, mean intraoperative heart rate was significantly lower in the block group (74.2 ± 6.4 vs 91.4 ± 6.8 beats/min, $P < 0.001$). However, the duration of surgery did not differ significantly between the two groups (141.7 ± 8.7 vs 141.6 ± 9.9 min, $P = 0.969$) [Table-2].

Table 2: Intraoperative outcomes (as observed intraoperative differences)

Variable	Block (n=15)	No block (n=15)	P value
Mean intraoperative SBP, mmHg	111.93 ± 5.54	128.87 ± 6.17	<0.001
Mean intraoperative HR, beats/min	74.20 ± 6.39	91.40 ± 6.79	<0.001
Operating time, min	141.73 ± 8.69	141.60 ± 9.88	0.969

The lower intraoperative haemodynamic values are consistent with the concept that effective regional analgesia may attenuate the haemodynamic response to surgical stimulation. Similar reductions

in blood pressure and heart rate after BSCPB have been reported in randomized clinical studies. [13]

Postoperative pain scores were significantly lower in patients receiving BSCPB. At 1 h after surgery,

the median VAS was 4 (IQR 3–4) in the block group compared with 6 (IQR 5–7) in the no-block group ($P<0.001$). At 4 h, median VAS remained significantly lower in the block group at 4 (IQR 4–5) compared with 8 (IQR 7.5–9) in the no-block group ($P<0.001$).

The proportion of patients with VAS >4 was significantly lower in the block group at both assessed time points. At 1 h, only 2 patients (13.3%) in the block group had VAS >4 compared with 14 patients (93.3%) in the no-block group ($P<0.001$). At 4 h, VAS >4 was observed in 7 patients (46.7%) in the block group compared with all 15 patients (100%) in the no-block group ($P=0.002$). Pain increased between 1 and 4 h in both groups, but the magnitude of increase was

significantly smaller in the block group. The mean increase in VAS was 0.87 ± 1.25 points following BSCPB compared with 1.87 ± 1.13 points in the no-block group ($P=0.013$). A substantial difference was observed in the time to first rescue analgesia. The median time was 280 min (IQR 240–295) in the block group compared with 60 min (IQR 45–67.5) in the no-block group ($P<0.001$). Thus, BSCPB was associated with an approximately 220-min longer median analgesia duration before rescue medication was required. This finding is particularly relevant because early postoperative analgesic requirement is a clinically meaningful measure of the duration of regional analgesia. The result is consistent with randomized trials and meta-analyses reporting delayed first analgesic requirement after BSCPB. [12,18,19] [Table 3].

Table 3: Postoperative pain and rescue analgesia

Outcome	Block (n=15)	No block (n=15)	P value
VAS at 1 h, median (IQR)	4 (3–4)	6 (5–7)	<0.001
VAS at 4 h, median (IQR)	4 (4–5)	8 (7.5–9)	<0.001
VAS >4 at 1 h, n (%)	2 (13.3%)	14 (93.3%)	<0.001
VAS >4 at 4 h, n (%)	7 (46.7%)	15 (100%)	0.002
Change in VAS, 4 h – 1 h, mean $\pm$ SD	0.87 ± 1.25	1.87 ± 1.13	0.013
Time to first rescue analgesia, median (IQR), min	280 (240–295)	60 (45–67.5)	<0.001

PONV occurred in 4 patients (26.7%) in each group, with no statistically significant difference between the groups ($P=1.000$). Similarly, there was no difference in hospital stay. Mean hospital stay was 3.07 ± 0.26 days in both groups ($P=1.000$), with one patient in each group requiring 4 days of hospitalization [Table-4].

Table 4: PONV and hospital stay

Outcome	Block (n=15)	No block (n=15)	P value
PONV, n (%)	4 (26.7%)	4 (26.7%)	1.000
Hospital stay, mean $\pm$ SD, days	3.07 ± 0.26	3.07 ± 0.26	1.000
4-day hospital stay, n (%)	1 (6.7%)	1 (6.7%)	1.000

Overall, the available data demonstrate that addition of bilateral superficial cervical plexus block to general anesthesia was associated with significantly lower postoperative pain scores and a substantially longer time to rescue analgesia, without a demonstrable effect on operating time, PONV or duration of hospital stay.

Statistical Interpretation: The strongest treatment-related findings in this dataset are therefore:

- VAS at 1 h: median 4 vs 6, $P<0.001$
- VAS at 4 h: median 4 vs 8, $P<0.001$
- VAS >4 at 1 h: 13.3% vs 93.3%, $P<0.001$
- VAS >4 at 4 h: 46.7% vs 100%, $P=0.002$
- Time to rescue analgesia: median 280 vs 60 min, $P<0.001$
- PONV: 26.7% vs 26.7%, $P=1.000$
- Operating time: 141.7 vs 141.6 min, $P=0.969$
- Hospital stay: 3.07 vs 3.07 days, $P=1.000$

Discussion

The present randomized comparative study demonstrates a substantial beneficial effect of

bilateral superficial cervical plexus block when added to general anaesthesia for thyroid operations. The most important findings were significantly lower postoperative VAS scores at 1 and 4 hours, a markedly lower proportion of patients experiencing clinically significant pain, and a substantial prolongation of the time to first rescue analgesia.

The magnitude and consistency of the observed analgesic effect are clinically relevant. The median VAS was reduced by two points at 1 hour and four points at 4 hours in the block group. Furthermore, almost all patients without the block had VAS >4 at 1 hour, whereas this occurred in only 13.3% of patients receiving BSCPB. At 4 hours, all patients in the no-block group continued to have VAS >4 compared with less than half of the block group.

These findings support the concept that the superficial cervical plexus is an important contributor to pain following thyroid surgery. The cervical incision traverses tissues supplied by branches of the superficial cervical plexus, and blockade of these sensory nerves before or around

the period of surgical stimulation can reduce afferent nociceptive transmission.

The results are consistent with the early randomized work of Dieudonne et al., who reported improved post-thyroidectomy analgesia following bilateral superficial cervical plexus block with bupivacaine and epinephrine. [8] Similarly, Andrieu et al. found that BSCPb with ropivacaine reduced postoperative analgesic requirements and PACU pain scores compared with placebo. [11]

The present findings are also in agreement with Karthikeyan et al., who demonstrated that BSCPb using bupivacaine, with or without clonidine, reduced intraoperative fentanyl requirement, increased time to first postoperative analgesic requirement and reduced postoperative morphine consumption. [12]

More recent randomized evidence has strengthened the argument for BSCPb. A randomized study involving 46 thyroidectomy patients found lower intraoperative remifentanyl requirements and significantly lower VAS scores across several postoperative time points in the BSCPb group. [15] A separate randomized study involving 100 patients also reported reduced pain and opioid use following BSCPb. [13]

The finding that time to first rescue analgesia was prolonged from a median of 60 to 280 minutes is particularly noteworthy. This represents a clinically important extension of the analgesic period rather than merely a statistically significant difference in pain score. Mayhew et al., in their systematic review and meta-analysis of 14 randomized trials involving 1,154 patients, similarly reported significantly prolonged time to first analgesic requirement and reduced rescue analgesic requirement with BSCPb. [18]

The updated meta-analysis by Wilson et al. included 31 studies and 2,273 patients and reported significant reductions in postoperative opioid consumption, rescue analgesic requirements and VAS scores, together with prolonged analgesic duration. [19] A subsequent systematic review including 34 studies and 2,519 patients likewise concluded that BSCPb reduced postoperative pain, delayed the first rescue analgesic dose and reduced postoperative opioid consumption. [20] Nevertheless, not all published studies have demonstrated a benefit. Eti et al. found no significant reduction in postoperative patient-controlled analgesic consumption following BSCPb or wound infiltration with bupivacaine. [9] Herbland et al. similarly reported that ropivacaine BSCPb did not prevent postoperative pain after total thyroidectomy. [10] These conflicting findings highlight the importance of technique, timing,

concentration, volume and the background analgesic protocol.

Steffen et al. subsequently conducted a randomized controlled trial comparing bupivacaine BSCPb with placebo and found significantly less pain with bupivacaine, although analgesic consumption and length of stay did not differ significantly. [21] This observation is relevant to the current study because our data also demonstrated a strong difference in pain but no significant difference in hospital stay.

The absence of a significant effect on hospital stay in the present study should therefore not be interpreted as evidence against the usefulness of BSCPb. Hospital discharge is influenced by numerous factors beyond pain, including institutional protocols, drain management, airway observation, thyroid pathology, and biochemical monitoring and surgeon preference. The present study had identical mean hospital stay in both groups despite a large difference in early postoperative pain.

Similarly, PONV was identical at 26.7% in both groups. This finding is compatible with some previous literature. The 2018 meta-analysis by Mayhew et al. found no significant reduction in PONV despite improvements in pain and analgesic requirements. [18] However, other trials have reported lower PONV following BSCPb. Cai et al. found significantly lower PONV and rescue antiemetic requirements following ropivacaine BSCPb, [22] while the 2023 updated meta-analysis reported a statistically significant overall reduction in PONV. [19]

The discrepancy may relate to differences in opioid exposure, antiemetic prophylaxis, anaesthetic technique, patient characteristics and sample size.

The haemodynamic findings deserve cautious interpretation. In the present study, mean intraoperative SBP and heart rate were significantly lower in the block group. Similar reductions in blood pressure and heart rate have been reported in patients receiving BSCPb. [13] Effective blockade of nociceptive input can theoretically reduce sympathetic activation during surgical stimulation and consequently reduce intraoperative haemodynamic responses.

Operating time was virtually identical between groups. This is important because a difference in duration of surgery could itself influence postoperative pain and analgesic requirements. The absence of any meaningful difference in operative duration strengthens the interpretation that the observed postoperative analgesic differences were not explained by longer or shorter surgical procedures.

The findings also have implications for opioid-sparing perioperative practice. Thyroid surgery increasingly occurs in the setting of enhanced recovery and ambulatory or short-stay pathways. Contemporary trials demonstrate that postoperative analgesic requirements after thyroid surgery can often be managed with multimodal non-opioid regimens, reducing opioid exposure. [2] BSCPb can potentially form one component of such multimodal strategies.

The role of ultrasound guidance is another important consideration. Ultrasound-guided BSCPb has been evaluated in randomized trials, with evidence of improved analgesia and quality of recovery. A randomized trial involving thyroid cancer surgery found that ultrasound-guided BSCPb improved QoR-15 scores, reduced postoperative pain and PONV, prolonged time to rescue analgesia and improved patient satisfaction. [23] More recent randomized evidence has also compared ultrasound-guided BSCPb with intravenous lidocaine and demonstrated improvement in postoperative quality of recovery. [24] The current study has several strengths. First, the intervention and control groups were of equal size. Second, the primary clinical endpoint—postoperative pain—was assessed at predefined early postoperative time points. Third, the analysis included both pain intensity and time to rescue analgesia, providing complementary measures of analgesic efficacy. Fourth, categorical outcomes such as clinically significant pain and PONV were analysed using Fisher's exact test, which is appropriate for the small sample size.

There are, however, important limitations. The principal limitation is the relatively small sample size of 30 patients, with only 15 patients in each group. This substantially limits statistical power for less frequent outcomes such as PONV and hospital stay. This study also recorded only VAS at 1 and 4 hours. Many published studies assess pain over 12–24 hours. Therefore, the present results establish a strong early postoperative analgesic effect but cannot determine whether the benefit persists for the entire first postoperative day.

Despite these limitations, the consistency of the primary findings—lower VAS at both time points, fewer patients with VAS >4 and a fourfold or greater prolongation of median time to rescue analgesia—provides clinically meaningful evidence supporting the analgesic efficacy of BSCPb in this patient cohort.

Conclusion

In this randomized comparative study of 30 patients undergoing thyroid operations under general anaesthesia, addition of bilateral superficial cervical plexus block was associated with a

significant and clinically relevant improvement in early postoperative analgesia.

Patients receiving BSCPb had significantly lower VAS scores at both 1 and 4 hours after surgery, substantially fewer episodes of clinically significant pain, and a markedly prolonged time to first rescue analgesia. The median time to rescue analgesia was 280 minutes in the block group compared with only 60 minutes in the no-block group.

BSCPb did not significantly influence operating time, PONV or duration of hospital stay in the present cohort. The observed intraoperative reduction in systolic blood pressure and heart rate is potentially consistent with attenuation of surgical nociceptive responses. Overall, the findings support bilateral superficial cervical plexus block as an effective component of multimodal analgesia for thyroid surgery, particularly for controlling pain during the first several postoperative hours and delaying the need for rescue analgesia.

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