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Research Article

Ultrasound-guided bilateral superficial cervical plexus block after neck-lift and temporal-lift surgery: Retrospective observational pilot study

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ABSTRACT

Background: Postoperative analgesia after aesthetic neck surgery is poorly characterised, with limited published data on regional analgesic techniques. We report our initial experience with ultrasound-guided bilateral superficial cervical plexus block (SCPB) for neck-lift and temporal-lift procedures.

Methods: In this single-centre retrospective observational case-controlled series, six consecutive patients receiving bilateral SCPB (20 mL of 0.25% bupivacaine at the end of surgery) were compared with 21 contemporaneous controls receiving standard analgesia. All received IV paracetamol and tenoxicam, with on-demand tramadol as rescue. Pain was assessed using the Numeric Rating Scale (NRS, 0–10) at 0, 1, 6, 12, and 24 h, with total analgesic use during hospital stay and satisfaction (1–5 Likert scale) as secondary outcomes. Data are median (IQR); Mann–Whitney U and Fisher exact tests were used.

Results: Groups were balanced for age, sex, BMI, ASA status, and operative duration. NRS scores were lower with SCPB at every time point: 0 vs 3 in PACU and at 1 h ($P = 0.0002$), 0 vs 2 at 6 h ($P = 0.0003$), 0 vs 2 at 12 h ($P = 0.005$), and 0 vs 1 at 24 h ($P = 0.016$). SCPB patients required fewer total paracetamol vials during their hospital stay (median 2.5 vs 7.0; $P = 0.0003$) and fewer tenoxicam ampoules (2.0 vs 6.0; $P = 0.003$). Satisfaction was higher with SCPB (median 5 vs 3; $P = 0.0005$). No block-related complication occurred.

Conclusion: US-guided bilateral SCPB was associated with lower pain scores, reduced supplemental analgesic use, and higher satisfaction after aesthetic neck surgery. These hypothesis-generating findings should be confirmed in an adequately powered randomised trial.

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1. Introduction

Aesthetic neck surgery including neck lift (rhytidectomy) and temporal-lift procedures involves extensive subcutaneous undermining, platysmal manipulation, and long incision lines. Together these features generate moderate-to-severe early postoperative pain, which, if undertreated, predisposes the patient to haematoma

formation as well as to postoperative nausea and vomiting (PONV) and to a poorer overall experience [1–5].

Despite the frequency of these operations, published data specifically addressing analgesia after aesthetic neck surgery are limited. The usual approach is a multimodal regimen combining intravenous paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and opioids. However, this strategy has notable drawbacks in

this setting: opioids may cause sedation and PONV, while NSAID-related platelet dysfunction contributes to the risk of postoperative haematoma [1,2,5,6].

Throughout this manuscript, the standardised term 'superficial cervical plexus block' (SCPB) is used to refer to the technique; earlier literature may also describe this as bilateral SCPB (BSCPB). The superficial cervical plexus arises from the anterior rami of the spinal nerves. Its four terminal branches — the lesser occipital, great auricular, transverse cervical, and supraclavicular nerves — emerge posterior to the sternocleidomastoid muscle (SCM) at the level of Erb's point [7,8]. While these branches course within the superficial cervical fascia to supply the skin of the anterolateral neck, parotid and mastoid regions, upper anterior chest wall, and the skin overlying the clavicle and shoulder [9,10], our technique specifically targeted the intermuscular plane between the SCM and the anterior scalene muscle. This anatomical approach covers virtually the entire operative field of a neck or temporal lift, making our modified SCPB an anatomically rational target for regional analgesia in these procedures.

The analgesic efficacy of bilateral SCPB has been well established in thyroid surgery. The 2023 updated systematic review and meta-analysis by Wilson and colleagues, which pooled 31 randomised trials including 2,273 patients, found that SCPB significantly reduced postoperative opioid consumption, lowered NRS pain scores throughout the first 24 h, and shortened analgesic-free time after thyroidectomy [1]. A separate 2023 meta-analysis of 12 trials (866 patients) also reported a significant reduction in PONV, consistent with the earlier work of Mayhew et al. [2], subsequent randomised data [11], and the systematic review by Betancourt and Sanabria [4]. Beyond thyroidectomy, cervical plexus block has been shown to provide effective perioperative pain control across a range of other head-and-neck operations [12] as well as in anterior cervical-spine surgery [13].

To our knowledge, no published study has evaluated the role of SCPB in aesthetic neck surgery. We therefore report a retrospective series comparing SCPB with standard analgesia in patients undergoing neck lift and temporal lift procedures, with the primary aim of generating preliminary data to inform the design of a future adequately powered prospective trial. We hypothesised that bilateral SCPB would reduce postoperative NRS pain scores and supplemental analgesic consumption compared with standard multimodal analgesia alone.

2. Materials and Methods

This single-centre retrospective observational case-controlled series was conducted in accordance with the principles of the Declaration of Helsinki. The protocol was approved by the İstinye University Human Research Ethics Committee (Approval Number: 2026/252; Date: May 25, 2026) and individual written informed consent was waived in view of the retrospective study design.

2.1. Study design and participants

We screened all adult patients (18–70 years) who underwent elective neck lift, temporal lift, or combined neck-lift plus temporal-lift surgery at our institution between December 2025 and May 2026. Patients with ASA physical status I or II and without any of the following exclusion criteria were eligible: known allergy to local anaesthetics, active infection at the proposed injection site, uncorrected coagulopathy, current anticoagulant or antiplatelet therapy, severe hepatic or renal impairment, chronic opioid use, or previous cervical radiotherapy. Previous cervical radiotherapy was listed as an exclusion criterion because radiation-induced fibrosis and potential neuropathic injury to cervical structures may alter the expected spread of local anaesthetic, create pre-existing neurological symptoms that confound pain assessment, and complicate the interpretation of any postoperative neurological changes attributed to the block. Six consecutive patients in whom the attending anaesthesiologist elected to perform a US-guided bilateral SCPB constituted the SCPB group; the 21 eligible patients managed without a block during the same period formed the control group.

2.2. Anaesthetic management and block technique

General anaesthesia was administered according to the standard institutional protocol. Once the surgical procedure was complete and while the patient was still anaesthetised, a US-guided bilateral SCPB was performed in patients allocated to the block group. The phrenic nerve (C3-C5) courses deep to the investing cervical fascia, directly along the anterior surface of the anterior scalene muscle. In our study, the technique involved injecting the local anesthetic solution into the intermuscular plane between the sternocleidomastoid (SCM) and anterior scalene muscles. A B. Braun Stimuplex® Ultra 360® echogenic needle was advanced in-plane in a posterior-to-anterior direction, and 10 mL of local anaesthetic was deposited within the superficial cervical fascial plane on each side (total volume 20 mL), targeting the plane where the terminal branches of the superficial cervical plexus emerge. The injectate was prepared by diluting 10 mL of hyperbaric 0.5% bupivacaine with 10 mL of 0.9% saline, yielding a final concentration of approximately 0.25% bupivacaine. Patients were then emerged from anaesthesia in the usual fashion. No block was performed in the control group.

2.3. Postoperative analgesia

In both groups, postoperative analgesia followed a uniform multimodal regimen: an initial routine dose of intravenous paracetamol 1 g, tenoxicam 20 mg, and tramadol 100 mg was administered in the PACU, and subsequent doses (paracetamol up to every 8 h, tenoxicam up to every 12 h) were given only when the patient reported pain or discomfort and were withheld otherwise. Tramadol hydrochloride 100 mg IV was reserved as on-demand rescue analgesia and was administered by the ward nurse only at the patient's explicit request for severe breakthrough pain.

2.4. Outcome measures

The primary outcome was postoperative pain intensity, assessed using the Numeric Rating Scale (NRS; 0 = no pain, 10 = worst imaginable pain) in the PACU (0 h) and at 1, 6, 12, and 24 h postoperatively. Secondary outcomes were the total number of paracetamol vials and tenoxicam ampoules administered from PACU admission through discharge (including the initial routine PACU dose, reflecting the complete analgesic burden during the hospital stay); the number of additional tramadol ampoules administered on demand; the total tramadol consumption (mg); the time from PACU arrival to the first request for rescue tramadol (min); patient satisfaction at 24 h on a five-point Likert scale (1 = very dissatisfied to 5 = very satisfied); duration of hospital stay (hours); PONV; and haematoma.

2.5. Statistical analysis

In view of the small sample sizes, which preclude reliable normality testing, non-parametric methods were used throughout. Continuous variables are summarised as median and interquartile range (IQR) and were compared between groups using the Mann-Whitney U test. Categorical variables were compared using the Fisher exact test. Effect size for the Mann-Whitney comparisons was estimated using $r = Z / \sqrt{N}$,

with $r \geq 0.50$ considered large. Two-sided $P < 0.05$ was considered significant. No a priori sample-size calculation was performed, in keeping with the exploratory nature of the study; the observed effect sizes will inform the design of a confirmatory randomised trial. All analyses were performed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA).

3. Results

Twenty-seven patients were included: 6 in the SCPB group and 21 in the control group. Baseline demographic and procedural data are shown in Table 1. All 27 patients underwent the combined neck-lift plus temporal-lift procedure. The two groups were comparable for age ($P = 0.502$), sex distribution ($P = 0.204$), body mass index ($P = 0.097$), ASA physical status, and operative duration ($P = 0.392$). All patients were ASA physical status I or II.

NRS scores at every postoperative time point were significantly lower in the SCPB group (Table 2). Within the SCPB group, the median NRS was 0 in the PACU and at 1, 6, 12, and 24 h. In the control group the median NRS ranged from 3 in the PACU and at 1 h to 1 at 24 h. Effect sizes were large at the early time points — $r = 0.707$ at PACU and 1 h ($P = 0.0002$) and $r = 0.673$ at 6 h ($P = 0.0003$) — and remained moderate-to-large at 12 h ($r = 0.528$; $P = 0.005$) and 24 h ($r = 0.449$; $P = 0.016$).

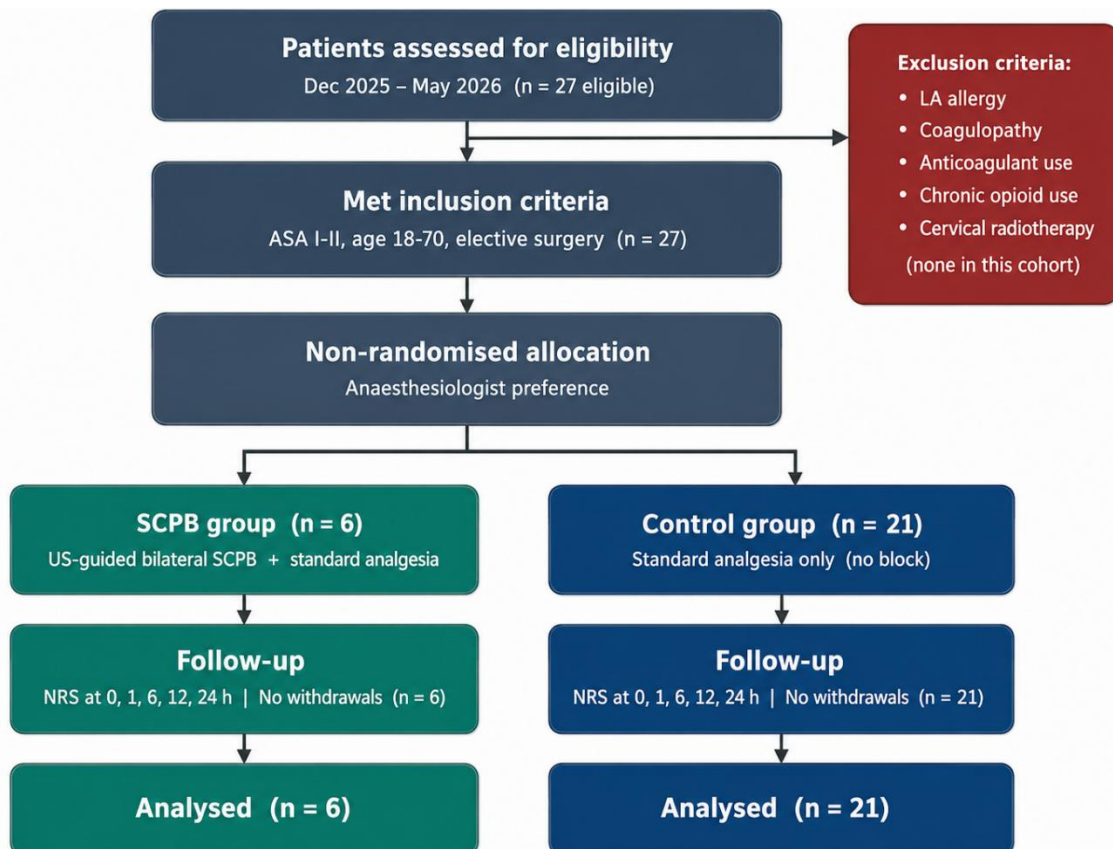


Fig. 1. STROBE-compliant patient flow diagram illustrating eligibility assessment, exclusion criteria, group allocation, follow-up, and analysis.

Table 1. Baseline characteristics.

Variable	SCBP group (n=6) median (IQR) or n (%)	Control group (n=21) median (IQR) or n (%)	P value
Age, years	54.5 (49.8–57.8)	57.0 (52.0–61.0)	0.502
Female sex, n (%)	4 (66.7)	19 (90.5)	0.204
BMI, kg/m ² , median (IQR)	25.0 (24.0–26.0)	27.0 (25.0–28.0)	0.097
ASA status I / II, n	1 / 5	0 / 21	0.222
Surgery duration, min	360 (338–360)	360 (345–420)	0.392

Data are median (IQR) or n (%). Mann–Whitney U test for continuous variables; Fisher exact test for categorical variables. BMI, body mass index; SCBP, superficial cervical plexus block.

Table 2. Postoperative NRS pain scores.

Time point	SCBP group (n=6) median (IQR)	Control group (n=21) median (IQR)	P value
PACU (0 h)	0 (0–0)	3 (2–4)	0.0002*
1 h	0 (0–0)	3 (2–4)	0.0002*
6 h	0 (0–0)	2 (1–3)	0.0003*
12 h	0 (0–0.75)	2 (1–2)	0.005*
24 h	0 (0–0.75)	1 (1–2)	0.016*

Data are median (IQR). Mann–Whitney U test.

*P < 0.05. PACU, post-anaesthesia care unit; SCBP, superficial cervical plexus block; NRS, Numeric Rating Scale.

3.1. Analgesic consumption and secondary outcomes

Postoperative analgesic use and secondary outcomes are summarised in Table 3. Patients in the SCBP group required significantly fewer total paracetamol vials (median 2.5 vs 7.0; $P = 0.0003$; $r = 0.690$) and tenoxicam ampoules (median 2.0 vs 6.0; $P = 0.003$; $r = 0.561$) over the course of the hospital stay. The number of additional tramadol ampoules did not differ significantly ($P = 0.124$), although total tramadol consumption tended to be lower with SCBP (median 50 mg vs 200 mg; $P = 0.071$). Only 2 of 6 SCBP patients (33.3%) requested rescue tramadol, versus 13 of 21 controls (61.9%; $P = 0.355$). Among those who requested tramadol, SCBP patients made their first request at a median of 780 min after PACU arrival versus 60 min in controls; this comparison is descriptive only, based on two SCBP patients.

Patient satisfaction was higher in the SCBP group (median 5 vs 3; $P = 0.0005$; $r = 0.640$). Hospital stay was similar between groups (median 48 h; $P = 0.360$). PONV was absent in all SCBP patients compared with 9 controls (42.9%; $P = 0.071$). Two haematomas occurred in the control group and none in the SCBP group ($P = 1.000$). No block-related complication — including phrenic nerve palsy, Horner syndrome, vascular puncture, or local-anaesthetic systemic toxicity — was observed in any of the six SCBP patients.

4. Discussion

In this retrospective observational case-controlled series, patients receiving ultrasound-guided bilateral SCBP demonstrated significantly lower NRS pain scores at all

five postoperative time points, reduced total non-opioid analgesic consumption over the hospital stay, and higher patient satisfaction scores compared with controls receiving standard multimodal analgesia alone. No block-related complications were observed. These findings provide the first available preliminary data on SCBP in aesthetic neck and temporal-lift surgery.

To our knowledge, no prior study has evaluated SCBP in this aesthetic surgical context, and the present series therefore provides the first available data on which to base the design of a prospective randomised trial.

Within the SCBP group, the median NRS remained at zero throughout the 24-hour observation period, in contrast to persistent mild-to-moderate pain in the controls. This observation should be interpreted with caution given the small sample size, and may in part reflect a floor effect of the NRS at the lower end of the scale. The median NRS of zero should be interpreted alongside the analgesic consumption data: the proactive administration of non-opioid analgesics upon the earliest signs of mild discomfort likely prevented pain-score escalation throughout the observation period. This pattern parallels findings from thyroid surgery, where SCBP has repeatedly been shown to reduce NRS pain scores, lower opioid requirements, and shorten time to discharge during the first 24 h [1,2,4]. The physiological rationale is direct: the cervicofacial dissection and platysmal manipulation performed during a neck or temporal lift involve skin and subcutaneous structures innervated almost entirely by the C2–C4 terminal branches of the superficial cervical plexus [9,10], which are precisely the targets of the SCBP technique used here.

Table 3. Analgesic consumption and postoperative outcomes.

Outcome	SCPB group (n=6) median (IQR) or n (%)	Control group (n=21) median (IQR) or n (%)	P value
Total paracetamol vials (hospital stay)	2.5 (2.0–3.0)	7.0 (5.0–8.0)	0.0003*
Total tenoxicam ampoules (hospital stay)	2.0 (0.3–3.0)	6.0 (5.0–6.0)	0.003*
Additional tramadol, ampoules	0 (0–1.5)	1 (0–4)	0.124
Total tramadol consumption, mg	50 (0–250)	200 (100–500)	0.071
Patients requesting rescue tramadol, n (%)	2 (33.3)	13 (61.9)	0.355
Time to first rescue tramadol, min	780 (600–960)†	60 (60–60)	—
Hospital stay, h	48 (30–66)	48 (48–72)	0.360
Patient satisfaction (1–5), median (IQR)	5 (5–5)	3 (2–3)	0.0005*
PONV, n (%)	0 (0)	9 (42.9)	0.071
Haematoma, n (%)	0 (0)	2 (9.5)	1.000

Data are median (IQR) or n (%). Mann–Whitney U test for continuous variables; Fisher exact test for categorical variables. Paracetamol and tenoxicam totals reflect all doses administered from PACU admission through discharge (median hospital stay 48 h), including the initial routine PACU dose. †Calculated only for the two SCPB patients who requested rescue tramadol. *P < 0.05. SCPB, superficial cervical plexus block; PONV, postoperative nausea and vomiting.

The significantly lower total consumption of paracetamol and tenoxicam in the SCPB group over the hospital stay lends further support to a real analgesic effect. The non-significant trends toward lower total tramadol use and lower PONV (both P = 0.071) are notable: opioid-sparing matters particularly in aesthetic neck surgery because opioid-induced nausea and vomiting may contribute to postoperative hypertension and agitation, recognised triggers of expanding haematoma [3,5]. Meta-analytic data in thyroid surgery indicate that SCPB reduces both opioid consumption and PONV [1]; our observations are directionally consistent with that hypothesis.

Although the earlier meta-analysis by Mayhew et al. [2] did not find a significant effect on PONV, the more recent update by Wilson et al. [1], which included 31 trials and 2,273 patients, demonstrated a statistically significant reduction (P = 0.02), aligning the meta-analytic evidence with the directional trend observed in our cohort.

Regarding the volume of local anaesthetic used: we administered 10 mL per side (total 20 mL of 0.25% bupivacaine, corresponding to a total bupivacaine dose of 50 mg, well within established safety margins). There is no universally accepted consensus on the optimal volume for SCPB; published studies have used volumes ranging from 5 to 20 mL per side [1,2,6]. In the absence of standardised dosing guidance for this technique in the aesthetic surgery context, a volume of 10 mL per side was selected as the minimum dose considered clinically sufficient to achieve reliable spread along the posterior SCM border while minimising the risks of inadvertent deep injection, local anaesthetic systemic toxicity, and phrenic nerve involvement. Whether smaller volumes would provide equivalent analgesia warrants evaluation in future prospective studies.

The anatomical relationship between the superficial cervical plexus block and the phrenic nerve warrants specific consideration. The phrenic nerve (C3–C5)

courses deep to the investing cervical fascia, directly along the anterior surface of the anterior scalene muscle. In our study, the technique involved injecting the local anesthetic solution into the intermuscular plane between the sternocleidomastoid (SCM) and anterior scalene muscles. When performed under real-time ultrasound guidance—ensuring the injectate is precisely deposited superficial to the deep investing fascia—the risk of inadvertent phrenic nerve involvement remains minimal. In published series of bilateral SCPB for thyroid surgery involving thousands of patients, clinically significant phrenic nerve palsy has not been reported as a complication of this technique [1,2]. Consistent with this evidence, no phrenic nerve palsy, Horner syndrome, or other neurological complication was observed in any of the six SCPB patients in the present series.

The high patient satisfaction with SCPB (median 5 vs 3; P = 0.0005; r = 0.640, large effect) is multifactorial: in elective aesthetic surgery, satisfaction encompasses freedom from pain, freedom from PONV, comfort during emergence, and the overall perioperative experience.

The findings regarding PONV and haematoma should be interpreted with particular caution. This study was not designed or powered to detect differences in these outcomes, and the apparent differences observed should be regarded as descriptive and purely exploratory. No conclusions about the effect of SCPB on PONV or haematoma can be drawn from this data.

Several important limitations must be explicitly acknowledged. The most fundamental limitation is the non-randomised allocation of the intervention: patients were assigned to the SCPB group according to the individual attending anaesthesiologist's preference rather than by formal randomisation, which introduces a substantial and unquantifiable risk of selection bias and confounding. Patients who received the block may have differed systematically from controls in ways not captured by the recorded variables. The retrospective single-cen-

tre design precludes causal inference, the total sample size is small ($n = 27$), the SCPB group is very small ($n = 6$), and the group sizes are markedly unequal. No adjustment for potential confounders was performed. Analgesic consumption was extracted from routine clinical records rather than prospectively collected, which may have introduced ascertainment bias. The possibility that the proactive administration of scheduled non-opioid analgesics influenced pain scores, maintaining a floor NRS of zero in the SCPB group, cannot be excluded. Given these limitations, all statistically significant findings should be regarded as hypothesis-generating rather than confirmatory, and the reported effect sizes are provided solely to inform sample-size calculations for a future adequately powered randomised trial.

Notwithstanding these limitations, the consistency of the observed differences across five sequential NRS time points and two analgesic-consumption endpoints, together with the complete absence of block-related adverse events in all six patients, provides preliminary support for further evaluation of US-guided bilateral SCPB in aesthetic neck surgery.

5. Conclusions

In this small retrospective observational series, US-guided bilateral superficial cervical plexus block was associated with significantly lower postoperative pain scores, lower supplemental analgesic requirements during the hospital stay, and higher patient satisfaction compared with standard analgesia alone after neck-lift and temporal-lift surgery, with no block-related complications. These preliminary findings demonstrate the feasibility of SCPB in aesthetic neck surgery and provide the effect-size estimates needed to design an adequately powered prospective randomised trial.

REFERENCES

- Wilson L, Malhotra R, Mayhew D, Banerjee A. The analgesic effects of bilateral superficial cervical plexus block in thyroid surgery: A systematic review and meta-analysis. *Indian J Anaesth.* **2023**;67(7):579–589.
- Mayhew D, Sahgal N, Khirwadkar R, Hunter JM, Banerjee A. Analgesic efficacy of bilateral superficial cervical plexus block for thyroid surgery: Meta-analysis and systematic review. *Br J Anaesth.* **2018**;120(2):241–251.
- Gupta V, Winocour J, Shi H, Shack RB, Grotting JC, Higdon KK. Preoperative risk factors and complication rates in facelift: Analysis of 11,300 patients. *Aesthet Surg J.* **2016**;36(1):1–13.
- Betancourt C, Sanabria A. Post-thyroidectomy bilateral cervical plexus block relieves pain: A systematic review. *Eur Arch Otorhinolaryngol.* **2024**;281(7):3765–3778.
- Kleinberger AJ, Spiegel JH. What is the best method for minimizing the risk of hematoma formation after rhytidectomy? *Laryngoscope.* **2015**;125(3):534–536.
- Gürkan Y, Taş Z, Toker K, Solak M. Ultrasound guided bilateral cervical plexus block reduces postoperative opioid consumption following thyroid surgery. *J Clin Monit Comput.* **2015**;29(5):579–584.
- Ahiskalioglu A, Yayik AM, Oral Ahiskalioglu E, et al. Ultrasound-guided bilateral superficial cervical block and preemptive single-dose oral tizanidine for post-thyroidectomy pain: A randomized-controlled double-blind study. *J Anesth.* **2018**;32(2):219–226.
- Peksöz U, Öner F, Ahiskalioglu A. Superficial cervical plexus block for retroauricular mass excision in a patient with high risk of general anaesthesia: A case report. *Turk J Anaesthesiol Reanim.* **2022**;50(2):148–150.
- Pandit JJ, Dutta D, Morris JF. Spread of injectate with superficial cervical plexus block in humans: An anatomical study. *Br J Anaesth.* **2003**;91(5):733–735.
- Kim JS, Ko JS, Bang S, Kim H, Lee SY. Cervical plexus block. *Korean J Anesthesiol.* **2018**;71(4):274–288.
- Karakış A, Tapar H, Özsoy Z, Suren M, Dogru S, Karaman T, et al. Perioperative analgesic efficacy of bilateral superficial cervical plexus block in patients undergoing thyroidectomy: A randomized controlled trial. *Braz J Anesthesiol.* **2019**;69(5):455–460.
- Patel H, Shah N, Syed A, Shah P, Macwan S. Evaluating the analgesic efficacy of superficial cervical plexus block for head and neck surgeries: A comparative randomized control study. *Cureus.* **2023**;15(5):e39303.
- Kamel AAF, Fahmy AM, Fathi HM, Elmesallamy W, Khalifa OYA. Regional analgesia using ultrasound-guided intermediate cervical plexus block versus cervical erector spinae block for anterior cervical spine surgery: A randomized trial. *BMC Anesthesiol.* **2024**;24:153.

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Conflict of Interest

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Data Availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

AI Assistance

During the preparation of this manuscript, ChatGPT (OpenAI) was used exclusively for language editing and stylistic refinement. The authors take full responsibility for the content, interpretation, and conclusions of the published article.

Ethics Approval and Consent to Participate

This single-centre retrospective observational case-controlled series was conducted in accordance with the principles of the Declaration of Helsinki. The protocol was approved by the İstinye University Human Research Ethics Committee (Approval Number: 2026/252; Date: May 25, 2026) and individual written informed consent was waived in view of the retrospective study design.

Author Contributions

Suleyman Ozkahraman: conceptualization, methodology, project administration, supervision, resources, formal analysis, visualization, writing – original draft, writing – review & editing.

Usun Mamasaliev: conceptualization, methodology, project administration, supervision, validation, resources, writing – review & editing.

Bora Bilal: writing – original draft, writing – review & editing.