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ORIGINAL ARTICLE

Incidence of hemi-diaphragmatic paresis after ultrasound-guided intermediate cervical plexus block: a prospective observational study

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Abstract

Purpose An intermediate cervical plexus block (CPB) targets the posterior cervical space between the sternocleidomastoid muscle and the prevertebral fascia. The phrenic nerve descends obliquely on the surface of the anterior scalene muscle beneath the prevertebral fascia after originating from the C3–C5 ventral rami. Therefore, the phrenic nerve can be affected by a local anesthetic during an intermediate CPB, depending on the permeability characteristics of the prevertebral fascia. This study investigated whether an intermediate CPB affects the phrenic nerve, inducing hemidiaphragmatic paresis.

Methods In this prospective observational study, 20 patients undergoing single-incision transaxillary robot-assisted right thyroidectomy were enrolled. The intermediate CPB (0.25% ropivacaine 0.2 ml/kg) was performed at the C4–5 intervertebral level carefully, without penetrating the prevertebral fascia, before the patient emerged from general anesthesia. Diaphragmatic motions of the block side were measured by M-mode ultrasonography at three time points: before anesthesia (baseline) and at 30 and 60 min after the intermediate CPB. Hemidiaphragmatic paresis was divided into three grades, depending on the percentage of diaphragm movement compared to the baseline: none (> 75%), partial paresis (25–75%), and complete paresis (< 25%).

Results No patient showed any partial or complete ipsilateral hemidiaphragmatic paresis within 60 min after the intermediate CPB.

Conclusion Intermediate CPB using 0.2 ml/kg of 0.25% ropivacaine at the C4–5 intervertebral level did not cause ipsilateral hemidiaphragmatic paresis. This may imply that the effect of the intermediate CPB on the phrenic nerve is not significant.

Keywords Diaphragm · Intermediate cervical plexus block · Paresis · Phrenic nerve

Introduction

Intermediate cervical plexus block (CPB) is designed to target the posterior cervical space (PCS) that creates the interfascial space between the sternocleidomastoid muscle and the prevertebral fascia (the deep layer of the deep cervical fascia) [1] at the C4 level [2]. A more distal intermediate CPB can be performed to selectively block the supraclavicular branches of the cervical plexus (e.g. for clavicle surgery) [3]. Since the PCS can be identified only on cross-sectional imaging, an ultrasound-guided technique is required for a safe, successful intermediate CPB. However, complications related to intermediate CPB have not been widely studied.

Phrenic nerve palsy is a significant complication associated with peripheral nerve blocks performed in the neck area [4–6]. The phrenic nerve arises chiefly from the ventral ramus of the C4 nerve with contributions from the C3 and C5 nerves [7]. After the phrenic nerve descends to reach the upper part of the lateral border of the anterior scalene muscle, it runs down obliquely on the surface of the anterior scalene muscle, from the lateral to the medial side, beneath the prevertebral fascia [7, 8]. Therefore, the phrenic nerve may be affected by a local anesthetic during an intermediate CPB depending on the prevertebral fascia permeability.

The permeability of the prevertebral fascia covering the phrenic nerve was investigated in two cadaveric studies [9, 10], but conflicting results were presented. Moreover, there

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has been no previous clinical study evaluating the permeability characteristics of the prevertebral fascia that may explain whether the intermediate CPB affects the phrenic nerve. Nonetheless, several CPB studies [11–13] have already been published under the assumption that the prevertebral fascia is permeable.

A single-incision transaxillary robotic thyroidectomy produces moderate neck and axillary pain during the immediate postoperative period; the neck pain can be reduced by ultrasound-guided intermediate CPB [14], and the axillary pain can be reduced by ultrasound-guided serratus-intercostal plane block [14] or local anesthetic wound infiltration [15]. In this study, we conducted an ultrasound-guided intermediate CPB using 0.2 ml/kg of 0.25% ropivacaine at the C4–5 intervertebral level, combined with local anesthetic wound infiltration along the axillary incision after a single-incision transaxillary robotic thyroidectomy and investigated whether the ultrasound-guided intermediate CPB causes ipsilateral hemidiaphragmatic paresis due to phrenic nerve palsy.

Methods

Study population

This prospective observational study was approved by Institutional Review Board of Ajou University School of Medicine (AJIRB-MED-THE-18-268, Chairperson Sang-Uk Han) on 09 November 2018 and registered with the Clinical Trial Registry of Korea (https://cris.nih.go.kr; identifier KCT0003933). Written informed consent was obtained from all participants. Twenty adult patients scheduled for right transaxillary single-incision robotic thyroidectomy were enrolled between January 29, 2019 and September 26, 2019 at Ajou University Hospital, Suwon, Korea. The exclusion criteria were coagulopathy, known allergies to local anesthetics, ASA physical status higher than III, a moderate to severe decrease in preoperative pulmonary function, or abnormality in preoperative chest radiography data (pleural effusion, pneumothorax, or hemidiaphragm elevation).

Anesthetic management and surgical procedure

All patients arrived in the operating room without premedication; anesthesia was induced with propofol (2 mg/kg) and remifentanil (effect site concentration of 2.0 ng/ml) after routine monitors were applied. Following an 0.8 mg/kg injection of rocuronium intravenously, endotracheal intubation was performed after confirming a train-of-four count of 0. Anesthesia was maintained using sevoflurane (0.7–1.3 minimal alveolar concentration) and remifentanil (effect site concentration of 1–3 ng/ml). Next, 0.3–1.0 cg/kg/min of rocuronium was infused to achieve a train-of-four count of 0 or 1 during the entire surgery. The neuromuscular blockade was reversed by sugammadex (2 mg/kg) after confirming a train-of-four count of 2; when a train-of-four ratio was more than 90%, extubation was performed.

Thyroidectomy was performed through a gasless transaxillary approach by two experienced surgeons. After inducing anesthesia, the patient's neck was extended using a shoulder roll, and the right arm was extended and rotated cephalad to expose the axilla. Afterwards, a 5–6 cm vertical skin incision was made just posterior to the anterior axillary fold. From the axilla to the anterior neck area, a subplatysmal skin flap was dissected superficial to the pectoralis major muscle by electrical cautery under direct vision. After exposing the sternocleidomastoid muscle, the thyroid was approached through the avascular space between the sternal and clavicular heads of the sternocleidomastoid muscle. Once the working field was secured, the thyroid retractor and robot arms were placed, and the right thyroidectomy with ipsilateral central compartment lymph node dissection was initiated.

Intermediate cervical plexus block and wound infiltration technique

An intermediate CPB was performed after the surgery, before the patient emerged from anesthesia, by a single anesthesiologist who was skilled in block techniques (J.S.K.). For the ultrasound-guided intermediate CPB, the patient's head was rotated to the opposite direction slightly in a supine position, and a 13–6 MHz linear ultrasound transducer (SonoSite Edge; FUJIFILM SonoSite Inc, Bothell, Washington) was placed on the corresponding side of the neck in the transverse orientation. While tracking the C4–5 intervertebral level from the C7 vertebral level, we tried to identify the phrenic nerve migrating from the medial to the lateral side of the anterior scalene muscle surface (Fig. 1a), although the phrenic nerve was not always identifiable in each patient. Once the transducer reached the C4–5 intervertebral level, after scanning the predicted needle pathway using color Doppler mode, the 23-gauge, 60-mm needle (KOVAX-needle, Korea vaccine, Ansan, Korea) was advanced from the lateral to medial direction using an in-plane technique, and 0.2 ml/kg of 0.2% ropivacaine (Ropivacaine 150 mg/20 ml 0.75% Inj, Fresenius Kabi, Norge AS, Norway) was injected into the interfascial space between the sternocleidomastoid muscle and the prevertebral fascia (Fig. 1b, c). During the procedure, special care was taken to avoid inadvertent penetration of the prevertebral fascia with the needle and medial spread of the local anesthetic toward the carotid artery or internal jugular vein. After completing the intermediate CPB, we also performed subcutaneous wound infiltration with 20 ml of 0.25% ropivacaine along the axillary incision line since the intermediate CPB could not cover the axillary pain postoperatively.

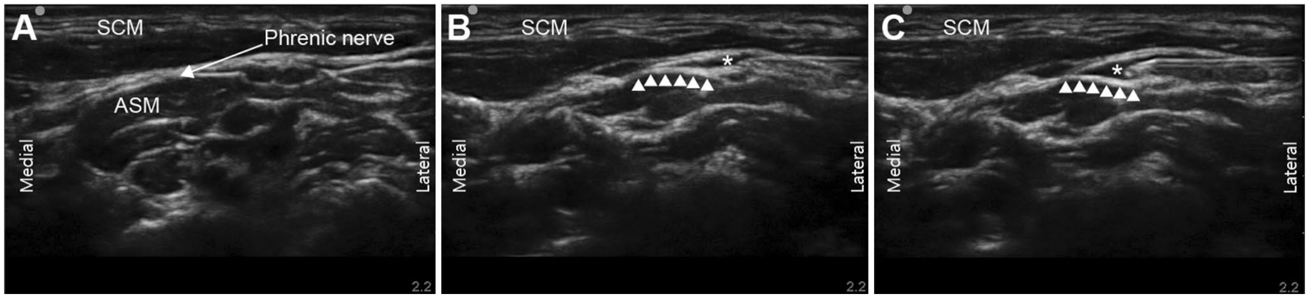

Fig. 1 Ultrasonographic images of the phrenic nerve and intermediate cervical plexus block. **a** The phrenic nerve is seen on the surface of the anterior scalene muscle at the C6–7 intervertebral level. **b** Initial spread of the local anesthetic (*) in the posterior cervical space with a slight depression of the prevertebral fascia during the intermediate cervical plexus block at the C4–5 intervertebral level. The phrenic nerve is not seen at this level. **c** Increased depression of the prevertebral fascia is observed with an increase in the local anesthetic injection volume. *ASM* anterior scalene muscle, *SCM* sternocleidomastoid muscle. The white arrowheads indicate the prevertebral fascia

Block assessment

At 30 and 60 min after admission to the post-anesthesia care unit, intermediate CPB success was evaluated using a cold sensation in four different areas: post-auricular—lesser occipital nerve, ear lobe—great auricular nerve, mid-level of the neck— transverse cervical nerve, and clavicle—supraclavicular nerve. The degree of cold sensation was divided into three grades: normal, blunted, and loss of sensation. If the patient showed a blunted or loss of sensation in all four areas, the intermediate CPB was considered to have blocked the superficial cervical plexus successfully.

Assessment of diaphragmatic movement and other outcomes

Hemidiaphragmatic movement was evaluated by ultrasonography using a 5–2 MHz curvilinear transducer (SonoSite Edge; FUJIFILM SonoSite Inc, Bothell, Washington) by a single anesthesiologist (H.Y.K.). The transducer was placed at the right subcostal margin in the anterior axillary line in the supine position and was directed cephalad and dorsally to make the ultrasound beam reach the posterior third of the hemidiaphragm perpendicularly [16, 17]. Diaphragmatic excursions of the block side were measured by M-mode ultrasonography using the liver as an acoustic window during quiet and deep breathing sessions at three time points: before inducing anesthesia (baseline) and at 30 min and 60 min after admission to the post-anesthesia care unit (at the same time as evaluation of the loss of cold sensation). Each measurement was performed three times, and the mean value was calculated. Hemidiaphragmatic paresis was divided into three grades, depending on the percentage of diaphragm movement compared with baseline: none (> 75%), partial paresis (25–75%), and complete paresis (< 25%) [18]. Hemidiaphragmatic paresis was considered to be present if partial or complete paresis occurred [19, 20].

Postoperative pain was evaluated using a visual analog scale (0 = none, 10 = the worst) in response to a gentle external pressure at 0, 1, 3, 6, 9, and 24 postoperative hours over the neck, anterior upper chest, and axilla. Rescue analgesics were given when visual analog scale scores were more than 5 or upon patient request. Possible adverse effects, including dyspnea, chest discomfort, desaturation (pulse oximetry saturation < 95%), ipsilateral arm weakness or sensory changes due to brachial plexus block, Horner's syndrome, tongue deviation, facial palsy, and allergic reaction, were recorded.

Statistical analysis

As this was a pilot study, the sample size was empirically chosen. Based on the previous literature indicating that a sample size of 10–40 is appropriate [21], an initial goal of 20 patients was set. After considering a drop-out rate of 10%, the goal sample size was revised to 22 patients. Categorical variables are presented as number and frequency. Continuous variables showing normality are expressed as mean ± standard deviation, whereas those not showing normality are expressed as median values (25th–75th interquartile range). SPSS software (version 25.0, IBM Corporation, Armonk, NY, USA) was used for statistical analysis.

Results

After excluding two patients who declined to participate, we enrolled 22 patients who received an intermediate CPB with local wound infiltration. Among them, two patients were excluded for the following reasons: one patient received an incorrect dose of ropivacaine due to a disconnected injection line, and the other patient could not be examined for diaphragmatic motions because she suffered sudden abdominal pain in the post-anesthesia care unit. Finally, diaphragmatic motions were measured in 20 patients after the intermediate CPB. The study flow chart is shown in Fig. 2.

All patients received a transaxillary single-incision robotic right thyroidectomy with an ipsilateral central compartment lymph node dissection; all surgeries were completed without complications. The patients' demographics and operation details are presented in Table 1. The majority of patients were female (75%) and had an ASA physical status of 1 (75%).

The diaphragmatic excursion data during quiet and deep breathing in each patient are described in Table 2. No patient showed any partial or complete ipsilateral hemidiaphragmatic paresis at 30 or 60 min after the intermediate CPB. Pulse oximetry saturation was stable (> 95% without oxygen supply) in all patients, and there were no respiratory symptom complaints such as dyspnea or chest discomfort. In addition, ipsilateral weakness or sensory changes in the arm, facial palsy, Horner's syndrome, or tongue deviation did not occur in any patients.

Table 1 Demographics and operation details

Variables	Patients (*n* = 20)
Age (years)	36.2 ± 10.0
Sex [*n* (%)]	
Male	5 (25%)
Female	15 (75%)
Height (cm)	163.3 ± 7.1
Weight (kg)	60.8 (56.7–65.8)
Body mass index	22.9 ± 3.1
ASA [*n* (%)]	
I	15 (75%)
II	5 (25%)
Operation time (min)	142.7 ± 52.4
Anesthesia time (min)	193.5 ± 54.7

Continuous data are presented as mean ± standard deviation or median (interquartile range). Nominal data are presented as number (percentage)

ASA American Society of Anesthesiologist physical status

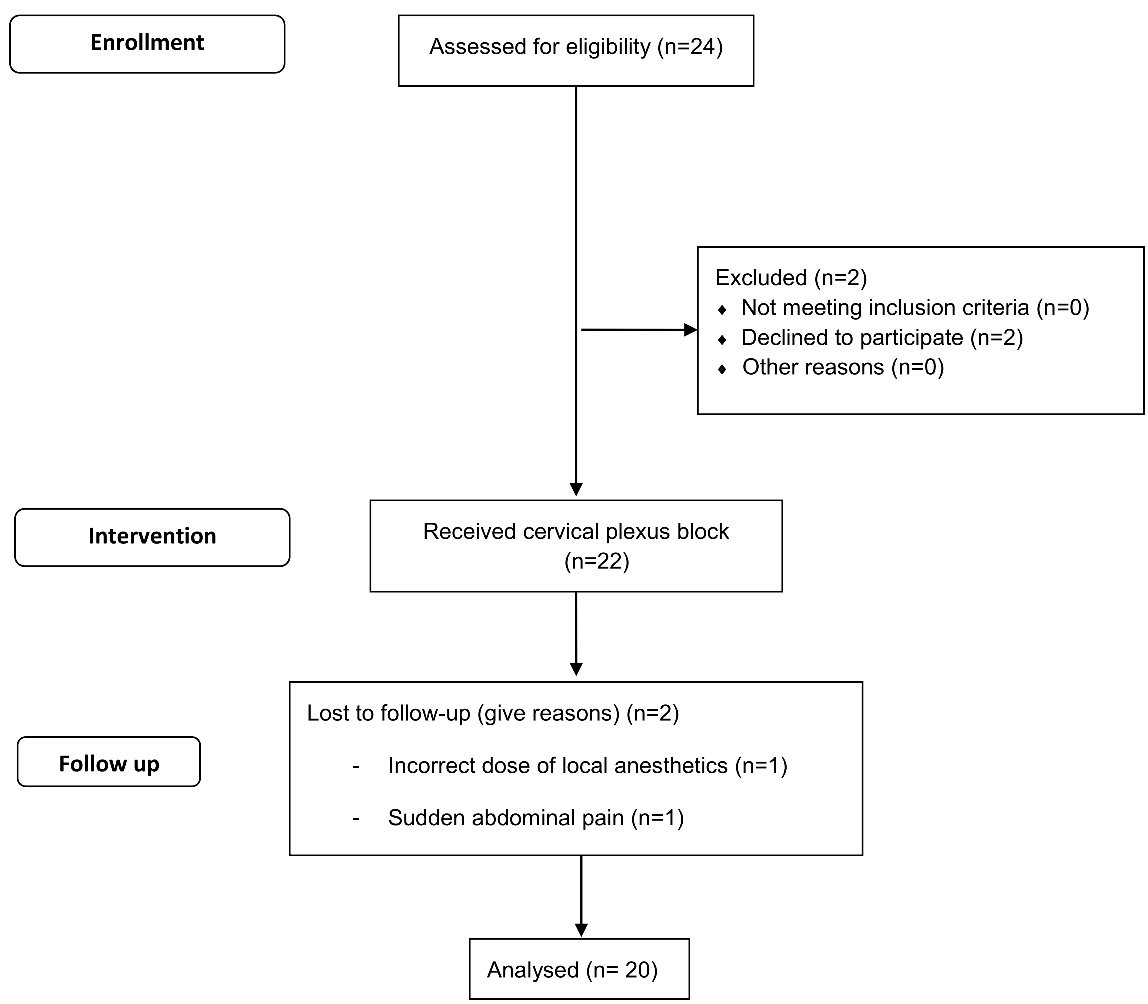

Fig. 2 A flow chart showing patient progress through the study phases

Table 2 Diaphragmatic excursion during quiet and deep breathing in each patient

Patient *N*	Baseline	30 min after ICPB	60 min after ICPB
1			
Quiet	2.16	2.24 (103.9)	2.22 (102.8)
Deep	4.57	4.48 (98.2)	4.37 (95.8)
2			
Quiet	2.35	2.54 (107.8)	2.37 (100.7)
Deep	5.31	5.36 (100.9)	5.40 (101.7)
3			
Quiet	2.41	2.55 (105.8)	2.54 (105.4)
Deep	5.14	4.44 (86.4)	4.59 (89.3)
4			
Quiet	2.31	2.16 (93.4)	2.03 (87.6)
Deep	4.18	4.30 (102.7)	4.18 (100.0)
5			
Quiet	2.37	2.00 (84.6)	2.14 (90.6)
Deep	3.54	3.61 (102.2)	4.16 (117.7)
6			
Quiet	2.71	2.31 (85.5)	2.48 (91.7)
Deep	4.37	4.45 (101.7)	4.27 (97.6)
7			
Quiet	2.20	2.47 (112.1)	2.25 (102.1)
Deep	4.50	4.42 (98.2)	4.39 (97.6)
8			
Quiet	2.23	2.24 (100.1)	2.17 (97.3)
Deep	4.24	4.32 (102.0)	4.31 (101.7)
9			
Quiet	2.88	2.31 (80.0)	2.52 (87.4)
Deep	4.21	4.24 (100.6)	4.21 (100.1)
10			
Quiet	2.71	2.08 (76.5)	2.57 (94.7)
Deep	4.53	4.53 (100.1)	4.62 (102.1)
11			
Quiet	2.32	2.43 (104.6)	2.86 (123.4)
Deep	4.34	4.51 (103.8)	4.51 (103.8)
12			
Quiet	2.40	2.40 (100.0)	2.50 (104.2)
Deep	4.52	4.68 (103.6)	4.59 (101.5)
13			
Quiet	1.68	2.10 (125.4)	2.02 (120.7)
Deep	4.77	4.37 (91.6)	4.08 (85.5)
14			
Quiet	2.10	2.16 (102.9)	2.13 (101.6)
Deep	4.08	4.39 (107.4)	4.52 (110.8)
15			
Quiet	1.65	2.00 (121.2)	2.06 (124.8)
Deep	3.66	3.59 (98.1)	3.73 (102.1)
16			
Quiet	1.82	1.86 (102.2)	1.89 (104.2)
Deep	6.65	6.37 (95.8)	6.43 (96.7)
17			
Quiet	2.05	2.06 (100.2)	2.10 (102.4)
Deep	4.62	4.66 (100.9)	4.49 (97.1)
18			
Quiet	1.59	1.89 (118.6)	2.04 (128.2)
Deep	4.28	4.55 (106.4)	4.47 (104.4)
19			
Quiet	2.19	2.12 (96.8)	2.14 (97.4)
Deep	5.14	5.23 (101.7)	5.37 (104.3)
20			
Quiet	2.81	2.81 (99.9)	2.70 (96.1)
Deep	4.51	4.72 (104.7)	4.75 (105.2)

The diaphragmatic excursions are measured in centimeters by M-mode ultrasonography during quiet and deep breathing. The parenthesis means the percentage in movement of diaphragm compared to baseline in each patient

ICPB intermediate cervical plexus block, *Quiet* quiet breathing, *Deep* deep breathing

During the stay in the post-anesthesia care unit, all patients showed a blunted or loss of sensation in the areas which are innervated by all four superficial branches of the cervical plexus. The postoperative visual analog scale for pain is shown in Fig. 3. Pain in the axillary area was consistently higher than pain in the neck and anterior chest areas during the first 24 postoperative hours. Five patients received rescue analgesics due to axillary pain in the post-anesthesia care unit. Pain in the neck and anterior chest was well controlled (visual analog scale scores < 3) in most patients.

Discussion

In this prospective observational study, an ultrasound-guided intermediate CPB with 0.2 ml/kg of 0.25% ropivacaine at the C4–5 intervertebral level did not produce ipsilateral hemidiaphragmatic paresis in any patient, while all patients showed a blunted or loss of sensation in the areas innervated by all four superficial branches of the cervical plexus. Moreover, no patients showed dyspnea, ipsilateral weakness or sensory changes in the arm, facial palsy, Horner's syndrome, or tongue deviation after the intermediate CPB. The mean visual analog scale pain scores for the neck and upper anterior chest were less than 1 during the first 24 postoperative hours.

Transient phrenic nerve palsy after regional anesthesia is an important clinical issue especially in patients with pre-existing respiratory dysfunction [20, 22], and it results from the spread of a local anesthetic to the phrenic nerve or its nerve roots (C3–5). CPB can be classified into deep,

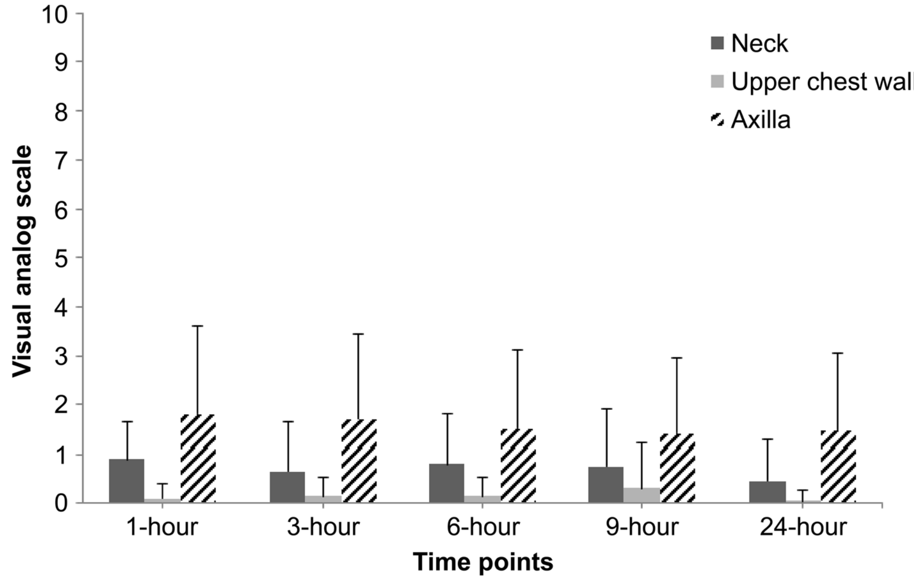

Fig. 3 Postoperative pain scores using a visual analog scale (0 = none, 10 = the worst) during the first 24 h after surgery. The mean visual analog scale scores are presented as a column chart with standard deviation bars

intermediate, and superficial CPBs [23–25]. Among them, deep CPB is reported to produce diaphragmatic dysfunction in 55–61% of patients [5, 6], because it is a paravertebral block targeting the C2, C3, and C4 nerve roots; the C3 and C4 nerve roots contribute to phrenic nerve formation. Contrarily, superficial CPB is a simple subcutaneous infiltration along the posterior border of the sternocleidomastoid muscle that does not appear to be related to phrenic nerve palsy, if performed correctly [26]. The intermediate CPB is an interfascial plane block targeting the PCS between the sternocleidomastoid muscle and the prevertebral fascia [2, 23, 25], and recently, it has been used more frequently in various head and neck surgeries [14, 25, 27, 28], including carotid endarterectomies [25], and in the treatment of chronic pain [29]; however, the relationship between intermediate CPB and phrenic nerve palsy has not yet been studied.

The prevertebral fascia is the deep layer of the deep cervical fascia [1] and forms a tubular sheath for the vertebral column and muscles associated with it [30]. The cervical plexus is located in a space between the middle scalene and longus capitis muscles at the C4 level beneath the prevertebral fascia [31]. The four superficial branches of the cervical plexus cross the PCS after piercing the prevertebral fascia before they emerge from the posterior border of the sternocleidomastoid muscle, whereas the phrenic nerve remains beneath the prevertebral fascia [7]. Therefore, the permeable nature of the prevertebral fascia is an important issue in determining whether an intermediate CPB affects the phrenic nerve. Pandit et al. [9] described, in their cadaveric study, that the prevertebral fascia might be porous because the dye injected spread into deep structures, including the phrenic nerve, beyond the prevertebral fascia, though the injection was made just below the investing fascia and superficial to the prevertebral fascia. Based on the study by Pandit et al. [9], Telford and Stoneham [23] reclassified the CPB approach by adding a new 'intermediate CPB' in the interfascial plane; they expected that an intermediate CPB could be a safer alternative to a deep CPB. More recently, Seidal et al. [10] reported that in non-embalmed cadavers, methylene blue injected into the PCS at the C4 level under ultrasound guidance did not disseminate into the deep tissues through the prevertebral fascia, and the phrenic nerve was not stained with methylene blue. These findings did not correlate with those of the study by Pandit et al. [9], and both studies were conducted in cadavers. If the prevertebral fascia is impermeable to a local anesthetic, the intermediate CPB would neither cause phrenic nerve palsy nor result in deep cervical plexus blockade, contrary to the theory of Telford and Stoneham [23].

To evaluate diaphragmatic motions after an intermediate CPB, transaxillary single-incision robotic thyroidectomy was selected since this surgery causes postoperative neck pain, originating from both the superficial tissue and the sternocleidomastoid muscle, which intermediate CPB at the C4 or C5 level can effectively treat [14, 28]. In this study, an intermediate CPB was performed at the C4–5 intervertebral level, slightly lower than the C4 level that Choquet et al. [2] suggested, to reduce the risk of sparing lower superficial branches of the cervical plexus such as the transverse cervical or supraclavicular nerves [32]. Regarding the volume and concentration of ropivacaine, a dose of 0.2 ml/kg of 0.25% ropivacaine was used, consistent with that of our previous ultrasound-guided intermediate CPB studies [14, 28]. We presumed that this volume and concentration of ropivacaine would be enough to block the phrenic nerve if ropivacaine contacts the phrenic nerve directly [33–35]. Partial phrenic nerve palsy produces a 25–75% reduction in diaphragmatic movement, and complete phrenic nerve palsy produces a 75% or greater reduction in diaphragmatic movement [18–20]. Thus, we considered hemidiaphragmatic paresis to be present if partial or complete paresis occurred. In this study, an intermediate CPB with 0.2 ml/kg of 0.2% ropivacaine did not produce ipsilateral hemidiaphragmatic paresis within 1 h after the block in all 20 patients, although the spread of local anesthetic within the PCS was observed with a depression of the prevertebral fascia during the injection (Fig. 1b, c), and all patients showed a blunted or loss of sensation in the areas innervated by all four superficial branches of the cervical plexus. Furthermore, no patients showed signs of Horner's syndrome after the intermediate CPB, as Alilet et al. demonstrated in their study [36]. The cervical sympathetic trunk is known to be located on the anterior medial surface of the longus capitis muscle beneath the prevertebral fascia at the C4 level [31]. These findings, thus, imply that the prevertebral fascia has low permeability to the local anesthetic.

During the procedure, two technical intermediate CPB strategies were utilized to avoid potential complications. First, the PCS was approached with shallow needle angles to avoid inadvertent prevertebral fascia injury with the needle that might allow the local anesthetic to flow into the deeper structures, including the phrenic nerve. Second, during the injection, if local anesthetic migration to the vicinity of the carotid artery or internal jugular vein was seen via ultrasonography, the injection was immediately stopped, and the needle tip was repositioned. This medial spread of the local anesthetic toward the carotid sheath and subsequent cephalad migration might produce cranial nerve blocks involving the facial nerve, vagus nerve and its branches (recurrent laryngeal and superior laryngeal nerves), and hypoglossal nerve [36–38]. In this study, no patient showed any signs of a facial or hypoglossal nerve block. However, postoperative vocal cord dysfunction (hoarseness) that may be associated with unilateral vagus or recurrent laryngeal nerve block was not evaluated since it is impossible to rule out the endotracheal intubation effect on the vocal cord [39] during the immediate postoperative period. Meanwhile, no patient showed signs of a brachial plexus block.

Limitations

First, this study was not conducted in a blinded comparative design. We considered that it is unethical to perform intermediate CPB in a comparative group with saline or by intentional penetration of the prevertebral fascia. Second, the study group was small. Third, only patients having a right-sided robotic thyroidectomy were enrolled because of the difficulty in evaluating diaphragmatic motion on the left side with M-mode. However, there is no difference between the right and left cervical course of the phrenic nerve in humans [8]. Fourth, considering the target level of intermediate CPB for single-incision transaxillary robotic thyroidectomy, we regretfully did not perform a distal intermediate CPB under the C6 level where the phrenic nerve runs more superficially just beneath the prevertebral fascia, although there does not seem to be a significant difference in the permeability characteristics of the prevertebral fascia according to small changes in location.

Conclusions

Intermediate CPB using 0.2 ml/kg of 0.25% ropivacaine at the C4–5 intervertebral level did not cause ipsilateral hemidiaphragmatic paresis. This may imply that the effect of the intermediate CPB on the phrenic nerve is not significant due to low permeability of the prevertebral fascia to the local anesthetic. Accordingly, intermediate CPB is not likely to produce deep cervical plexus blockade. Based on these findings, bilateral ultrasound-guided intermediate CPB may be considered safe. However, a bilateral block in a narrow neck area with complex fascial and neural structures should be performed with caution.

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Conflict of interest All authors declare that they have no conflicts of interest.

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