https://doi.org/10.48047/AFJBS.6.12.2024.6237-6244

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Postoperative Complications of Adding Dexmedetomidine as Adjuvant with Bupivacaine in Ultrasound-Guided Intermediate Cervical Plexus Block for Thyroidectomy: Randomized Controlled Study

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Article History

Volume 6, Issue 12, 2024

Received:25 June 2024

Accepted: 1August 2024

doi:

10.48047/AFJBS.6.12.2024.6237-6244

Abstract:

Background: Postoperative pain is a crucial element in assessing the quality of recovery after thyroidectomy. This work was aimed at assessing postoperative complications of using dexmedetomidine as a supplementary drug to bupivacaine in US-guided Intermediate CPB for thyroidectomy.

Methods: This randomized controlled double-blinded study was conducted on 40 patients, aged ≥ 18 and ≤ 60 years old, classified as ASA physical status II and III. Additionally, they underwent thyroidectomy for cancer thyroid. An Equal randomization for all participants took place into two groups administering bilateral intermediate CPB with 20 ml dosage of bupivacaine 0.25% alone within group A while with 1 µg/kg dosage of dexmedetomidine within group B. The block was performed following the GA induction.

Results: Age, sex, weight, height, body mass index, ASA physical status along with surgery period showed insignificant variances among all groups. Hypotension showed insignificant variance among all groups. Failed block and local anesthetic toxicity were not observed in any participant.

Conclusions: In patients undergoing thyroidectomy surgery, including dexmedetomidine as s supplementary drug to bupivacaine in US-guided intermediate CPB for thyroidectomy. is effective without increasing the occurrence of adverse events.

Keywords:Adjuvant, Bupivacaine, Cervical plexus block, Complications, Dexmedetomidine.

1. Introduction

Thyroid gland surgery has become more common as an ambulatory procedure among several countries. Postoperative wound pain frequently occurs, particularly during the first 24 hours following the surgical procedure. Such pain may cause a delay in discharge or even result in unexpected readmissions on the day following the operation [1].

Postoperative pain is a crucial element in assessing the quality of recovery after surgery. Ensuring sufficient pain control postoperatively is crucial for a prompt functional recovery, expediting early mobilization, along with facilitating discharge [2, 3].

Opioids are frequently used to reduce pain following the surgery [4]. However, adverse events associated with opioids, involving nausea, vomiting, along with respiratory depression, are not desired for patients undergoing ambulatory surgery [5]. Currently, multimodal analgesia for postoperative pain incorporates many strategies, such as local as well as regional anaesthesia, as essential elements [6].

The intermediate cervical plexus block (CPB) has offered more potent pain relief, particularly in deep regions developing an autonomic sympathetic or 'visceral' pain distribution [7]. Additionally, intermediate blocks have a much lower incidence of consequences, involving phrenic nerve palsy, Horner's syndrome, subarachnoid or epidural injection[8].

Nevertheless, the single shot nerve block features a short duration. Hence, supplementary drugs are utilized for peripheral nerve blocks, particularly in surgeries with shorter hospitalization periods, when the duration of analgesics is of utmost importance [2].

Dexmedetomidine stands as an alpha2 adrenoceptor (α2-AR) agonist, exhibiting a high level of selectivity, being ten times more selective in comparison to clonidine. Such a medicine features superior versatility in the field of anaesthesia and is used in a growing range of clinical conditions, not only for sedation in the ICU. The substance induces drowsiness, reduction of anxiety, along with relief from pain in a manner that is depending on the dosage. This effect occurs in both the spinal cord as well as supraspinal regions, with no respiratory depression[9, 10]. Dexmedetomidine augments the anaesthetic effects of other medications, induces perioperative sympatholysis, while reducing blood pressure via activating central α2 receptors [11, 12].

This work was aimed at assessing postoperative complications of using dexmedetomidine as a supplementary drug to bupivacaine in ultrasound guided Intermediate CPB for thyroidectomy.

Patients and Methods:

Our team designed a randomized controlled double-blinded study to include forty cases, with an age range falling between eighteen and sixty years, classified as American Society of Anesthesiologists (ASA) physical status II and III. Additionally, they underwent thyroidectomy for cancer thyroid. The research was conducted between September 2022 to March 2024, after

authorization from the Ethical Committee of Cairo University Hospitals. All participants were asked to sign a written consent.

We excluded cases developing prior sensitivity or those contraindicated to LA and/or dexmedetomidine, psychiatric conditions, retro-sternal goiter, altered anatomical landmarks, localized block site infection, and coagulopathy developing international normalized ratio (INR) ≥ 1.6

Randomization and blinding

Computer-generated randomization numbers were employed for allocating participants randomly, and each participant's code was securely stored in a sealed envelope. A random categorization was employed for all participants in a 1:1 ratio to two equal groups in a parallel manner. Group A, consisting of twenty participants, had bilateral intermediate CPB. Following the GA administeration, each participant was administered a dosage of 20 ml of bupivacaine 0.25%. Group B (n=20) received bilateral intermediate CPB, 20 ml dosage of bupivacaine 0.25% with 1 μg/kg dexmedetomidine after GA induction.

Patients and investigator were blinded to the group of the patient. Another anesthesiologist, nor participating in other steps of our research, prepared the study's solutions.

Our team took a comprehensive medical and surgical history from all participants. Clinical assessment was then conducted in addition to routine lab testing (complete blood picture, coagulation profile, liver and renal functions. Thereafter, ECG was employed for cases older than 40 years in addition to required investigations if needed for thoses exhibiting higher risks). Each participantreceived instructions on how to quantify postoperative pain with the Visual Analogue Scale (VAS. The score of 0 exhibits no pain" while 10 exhibits "the highest degree of pain intolearable") [13].

Intraoperative

In the holding room, partient monitoring was continuously conducted for pulse, blood pressure, oxygen saturation. Inserting an IV canula of 18-G was conducted for all participants. A Midazolam dosage of 0.02 mg/Kg was given. For all cases, 7-10 ml/kg of IV ringer acetate was administered if required to replace fluid deficiency 30 min before the surgery. It is necessary to have a portable US machine, resuscitation equipment, and medications such as epinephrine in addition to lipid emulsion, as well as sterile gloves and surgical towels.

The patient monitoring was continuously employed with ECG, NIBP, pulse oximeter, temperature probe and capnogram through the surgical period. An IVregimen consisting of 2 μg/kg of fentanyl in addition to a 2 mg/kg propofol dosage was administered to induce GA. Tracheal intubation was made easier by administering 0.5 mg/kg of IV rocuronium.

Following GA induction, all participants were administered bilateral intermediate CPB, either through a 20 ml bupivacaine 0.25% dosage within group A or a 20 ml bupivacaine 0.25% dosage in addition to a 1 μg/kg dosage of dexmedetomidine (precedex®) within group B.

The anaesthesia maintenance was conducted with inhaled sevoflurane at a concentration of 2-2.5% in oxygen-enriched air (FiO2=50%). Additional dosages of rocuronium (0.1 mg/kg) were given intravenously as needed. Each participant was administered 1 g of paracetamol intravenously.

Ultrasound-guided intermediate CPB technique:

The procedure was executed with meticulous aseptic measures. The block was was conducted in supine posture, they had their heads turned towards the other side. In order to examine the relative sternocleidomastoid (SCM) position as well as length, it is necessary to expose the participant's neck and upper chest. The Sonosite M-Turbo C 04TRGD US machine, equipped with the 10–12 MHZ linear array probe (HFL38), was employed for the ultrasound examination.

The skin was sterilized, and the transducer was positioned on the lateral neck, directly above the sternocleidomastoid muscle at its midpoint level (at the cricoid cartilage level). Following the SCM detection, the transducer was posteriorly shifted till the tapering posterior edge was centred on the screen. Next, an effort was made to identify the brachial plexus and/or the interscalene groove situated between the anterior and middle scalene muscles. The cervical plexus may be seen as a cluster of tiny, hypoechoic nodules with a honeycomb-like appearance. These nodules are located just above prevertebral fascia, which covers the interscalene groove. The injection for the intermediate CPB was administered between deep cervical fascia's investing layer and prevertebral fascia. After observing negative aspiration, a volume of 1-2 mL of LA was given to confirm the correct injection site. The remaining portion of LA was applied for enveloping the plexus. Extra fentanyl 0.5 µg/kg dosages were administered when the MAP or HR was elevated above 20% from their baseline values.

Following the operation, the residual neuromuscular blockade reversal was obtained with neostigmine (a dosage of 0.05 mg/kg) in addition to atropine (a dosage of 0.02 mg/kg). Then, the patient's airway reflexes were fully restored prior to extubation.

Following the surgical procedure, the participants were sent to the post anaesthesia care unit, where measurements of pain ratings, MAP, as well HR were recorded.

The patient monitoring was conducted at the postoperative care for a duration of 2 hours. If the pain score exceepaded 3 during the first 24 hours, rescue analgesia (3 mg boluses of IV morphine) was administered. Afterward, the participants were transferred to the ward, then received 1 g of paracetamol intravenously every 8 hours.

Our research also evaluated the negative consequences in the PACU. Hypotension, characterised by a 20% decrease in the basal MAP, was managed by administering intravenous fluids. Bradycardia, defined as a 20% decrease in the basal HR was treated with intravenous atropine at a dosage of 0.02 mg/kg. Respiratory depression, indicated by a SpO2 level below 95% and the need for supplemental oxygen, was also monitored. Additionally, postoperative nausea and vomiting (PONV) were assessed.

Statistical analysis

Our team analyzed the data statistically with SPSS v26 (IBM Inc., Chicago, IL, USA). The Shapiro-Wilks test in addition to histograms were employed for assessing the normality of data distribution. Quantitative parametric variables were showcased through mean and standard deviation (SD) then comparison among both groups was conducted utilizing unpaired Student's t- test. Quantitative non-parametric data were illustrated through median and interquartile range (IQR) then analysis was carried out with Mann Whitney-test. Qualitative variables were showcased through frequency and percentage (%) and analysis was made utilizing the Chi-square test or Fisher's exact test when appropriate. A two tailed P value of below 0.05 was deemed statistically significant.

Results

Age, sex, weight, height, BMI, ASA physical status along with the surgery showed insignificant variances among groups. Table 1

Table 1: Demographic data and surgery duration for all groups

		Group A (n=20)	Group B (n=20)	P value
Age (years)		42.3 ± 10.06	44.2 ± 8.11	0.515
Sex	**Male**	8 (40%)	7 (35%)	0.744
	Female	12 (60%)	13 (65%)	
Weight (kg)		78.15 ± 11.44	80.75 ± 11	0.468
Height (cm)		167.85 ± 6.61	164.05 ± 5.81	0.061
BMI (kg/m2)		27.71 ± 3.53	30.08 ± 4.2	0.060
ASA physical status	**II**	15 (75%)	13 (65%)	0.584
	III	5 (25%)	7 (35%)	
Duration of surgery (min)		90 ± 17.92	93.75 ± 17.46	0.507

Data is showcased through mean ± SD or frequency (%). BMI: Body mass index. ASA: American society of anesthesiologists.

Hypotension showed insignificant variances among groups. Failed block and local anesthetic toxicity didn’t occur in any patient in all groups. Table 2

Table 2: Complications for all groups

	Group A (n=20)	Group B (n=20)	P value
Failed block	0 (0%)	0 (0%)	---
Hypotension	3 (15%)	5 (25%)	0.695
Local anesthetic toxicity	0 (0%)	0 (0%)	---

Data is presented as frequency (%).

Discussion

Postoperative pain acts as a crucial element in determining the quality of recovery following the surgical procedure. Ensuring sufficient pain control postoperatively is crucial for a prompt functional recovery, expediting early mobility, along with facilitating discharge[6].

Regarding our results, hypotension was insignificantly different between both groups Failed block and local anesthetic toxicity didn't occur in any patient in the two groups.

Similar to our findings, Elshayeb et al. [14] addressed that, postoperative complications exhibited insignificant variances between bupivacaine 0.25%+0.5 ml plus (50 µg) dexmedetomidine group and bupivacaine only group.

Elmaddawy and Mazy [15] also noted that postoperative complications were insignificantly different between dexmedetomidine group and the bupivacaine group.

Our research has limitations of a modest sample size in addition to single-center settings. More studies in other centers and with larger sample size are needed to compare findings. Further studies are needed to compare with other adjuvants and using different types and doses of local anesthetics. Further studies are needed to use dexmedetomidine as a supplementary drug in other blocks in other operations. We suggest including dexmedetomidine as an adjunct to bupivacaine in US-guided intermediate CPB for thyroidectomy.

Conclusions:

In patients undergoing thyroidectomy surgery, including dexmedetomidine as a supplementary drug to bupivacaine in US-guided intermediate CPB for thyroidectomy. is effective without increasing the occurrence of adverse events.

Financial support and sponsorship: Nil

Conflict of Interest: Nil

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