EGYPTIAN JOURNAL OF ANAESTHESIA
2023, VOL. 39, NO. 1, 785–793
https://doi.org/10.1080/11101849.2023.2256564

The motor effects of 0.25% bupivacaine vs 0.19 bupivacaine in ultrasound-guided axillary brachial plexus block in pediatrics undergoing below-elbow orthopedic surgeries: A randomized controlled study

Abdelmoneim Adel Abdelmoneim, Sarah Abdelrasoul Hafez, Maha Gmail Hanna and Dalia Saad Abdel Kader

Anesthesiology, Surgical Intensive Care and Pain Management Department, Faculty of Medicine, Cairo University, Cairo, Egypt

ABSTRACT

Background: The standard dose of bupivacaine used in axillary brachial plexus block (ABPB) in pediatrics is 0.5 ml/kg of bupivacaine 0.25%. However, bupivacaine (0.19%) is still to be investigated for peripheral nerve block in pediatrics regarding the efficacy and adequacy of intra- and postoperative analgesia and degree of motor affection. We aimed to compare different concentrations (0.25%, 0.19%) of bupivacaine plus dexmedetomidine mixture to perform US-ABPB in pediatrics undergoing upper limb surgery distal to the elbow regarding affecting the postoperative motor power and adequacy of intra- and postoperative analgesia.

Methods: This prospective, randomised-controlled, double-blinded work was performed on 60 pediatric individuals presenting for upper limb orthopedic surgeries in the wrist, hand, and elbow distal to cubital fossa with surgical time planned to not exceed 1 h. 0.25% bupivacaine plus 1 µg/kg dexmedetomidine (Group A) or 0.19% bupivacaine in addition to 1 µg/kg dexmedetomidine (Group B) were given at random to participants. Motor power and pain were assessed using the Modified Bromage scale, Face, Legs, Activity, Cry, and Consolability (FLACC) score, respectively.

Results: A highly substantial variation was recorded between the two groups in Bromage 0 till Bromage 60 with higher values in group (B), and no substantial variation was found in Bromage 90 till Bromage 180 existed between the two groups. No substantial variation existed among the two groups with regard to FLACC score in FLACC0 (immediately after recovery), 1st hour after recovery, and 12th hour after recovery, and FLACC was significantly more ($p < 0.05$) in group B contrasted to group A in the 4th hour after recovery and 8th hour after recovery.

Conclusion: Using a lower concentration of bupivacaine (0.19%) plus dexmedetomidine (1 µg/kg) was associated with regain of postoperative motor power with the same postoperative analgesic efficacy compared to the standard concentration (0.25%) bupivacaine plus dexmedetomidine (1 µg/kg) in the early postoperative period in US-ABPB.

ARTICLE HISTORY
Received 31 July 2023
Revised 28 August 2023
Accepted 3 September 2023

KEYWORDS
Bupivacaine; dexmedetomidine; ultrasound-guided axillary block; pediatrics; below-elbow orthopedic surgeries

1. Introduction

Pediatric patients with orthopedic disorders often have postoperative pain, which is mostly caused by intraoperative tissue injury and insufficient intraoperative pain evaluation and treatment [1].

Regional anesthesia conduction among pediatric patients is a safe and effective technique that has created a remarkable improvement in postoperative pediatric pain management and reduced their need for postoperative opioids [2]. For use in upper limb orthopedic surgeries in hand, elbow, and wrist surgeries distally to cubital fossa, axillary brachial plexus block (ABPB) offers sensory and motor blocking along the spreading of the median, ulnar, radial, and musculocutaneous branches [3].

The motor sparing block provides adequate postoperative analgesia without affection of motor function this reduces postoperative discomfort and allows immediate postoperative mobility and early assessment of postoperative nerve injury, especially with mildly displaced radial fractured bones, carpal tunnel release, and Gelazzi-type fractures (distal third radial fractures with associated distal radioulnar joint-subluxation or -dislocation) [4]. The practice of postoperative physiotherapy is essential to improve postoperative patient outcome [5]. The widespread use of ultrasound in peripheral nerve blocks allows proper identification of nerve structures and so iinjection of minimum effective volume of local anesthetics. [6].

The standard dose of bupivacaine used in ABPB in pediatrics is bupivacaine 0.25% with dosage 0.5 ml/Kg that provides adequate intra and postoperative analgesia with marked postoperative motor affection [7]. However, bupivacaine (0.19%) [8], which is utilized for thoracolumbar caudal block, is

CONTACT Abdelmoneim Adel Abdelmoneim abdelmoneim_adel@kasralainy.edu.eg Anesthesiology, Surgical Intensive Care and Pain Management Department, Faculty of Medicine, Cairo University, Cairo, Egypt

still to be investigated for peripheral nerve block in pediatric regarding the efficacy and adequacy of intra and postoperative analgesia and degree of motor affection. In the current study, we investigated bupivacaine (0.19%) plus dexmedetomidine mixture and (0.25%) bupivacaine plus dexmedetomidine mixture for postoperative analgesic effectiveness and postoperative motor power restoration in pediatric patients having beneath elbow orthopedic surgeries using ultrasound guidance (US-ABPB).

The objective of this study was to compare two bupivacaine concentrations (0.25% or 0.19%)

plus dexmedetomidine mixture to perform US-ABPB in pediatric individuals having surgery on their upper limbs distal to the elbow.

2. Patients and methods

This prospective, randomised controlled double blinded trial was performed on 60 pediatric patients, ranging in age from 4 to 14 years, and having ASA class I-II presenting for upper limb orthopedic surgeries in the wrist, hand, and elbow distally to cubital fossa with surgical time planned to not exceed 1 h at operation rooms of Abu EL Reesh hospital of children, University of Cairo from June to September 2022.

Parents of the patients provided signed, fully informed permission. The Faculty of Medicine at Cairo University's Institutional Research Ethics Committee approved the current research before the research was conducted with (code: MS-621-2021) then the research was registered in Clinical Trials registration (ID: NCT05386095).

Exclusion Criteria were refusal of parents, evident infection where the needle was inserted, and coagulation issues (platelets less than or equal 50,000 and/or INR more than 1.5).

2.1. Randomization

Participants who met the criteria for the inclusion were chosen at random to Group A, which received 0.25% bupivacaine in addition to 1 µg/kg of dexmedetomidine, or Group B, which received 0.19% bupivacaine in addition 1 µg/kg of dexmedetomidine.

Randomization was done using computer-generated sequence. Concealment was obtained using opaque envelopes. The allocation envelope opening and the drug preparation were conducted by an assistant lecturer who was not involved in any of the study collection data. Anesthesia induction, US axillary block and maintenance were conducted according to specific groups.

2.2. Preoperative

At the Abu El-Reesh Pediatrics Hospital, Cairo University pediatric anesthetic section, all children were fasted for 6 h prior to surgery, with the exception of 2 h for oral clear liquid consumption. An hour prior to the procedure, participants went to the preparation area where they had a preoperative assessment and had their age and weight documented. Atropine and midazolam in a dose of 0.02 mg/kg each were provided for each child intramuscularly.

2.3. Intraoperative

Oxygen saturation, heart rate (HR), and non-invasive blood pressure were continually measured upon entering the operation room utilizing a standard monitor (Dräger Infinity Vista XL).

(100%) O_2 + Sevoflurane, inhalational anesthesia was used for induction of anesthesia in all patients. Atracurium 0.5 mg/kg and fentanyl 1 µg/kg were administered following the anesthesia was deepened and peripheral i.v. line was secured. Then, endotracheal tube was introduced and the ventilation was controlled to maintain CO_2 level at 30–35 mmHg utilizing an anesthetic machine (G.E.-Datex-Ohmeda, Avance CS2, USA). With the aim of maintaining the BIS measures between (40–60), anesthesia was preserved using isoflurane 1 MAC plus 50% oxygen in air, and atracurium top-ups of 0.1 mg/kg were administered every 30 min for neuromuscular blocking.

After the individual had received general anesthesia, the ipsilateral axillary brachial plexus block was performed by a skilled anesthetist under the guidance of ultrasound.

The SonoSite M Turbo (USA) ultrasound system and the linearly arrayed multi-frequency 6–13 MHz transducer probe (L25 × 6–13 MHz linear array) were used to conduct ABPB on patients while they were lying flat.

Figure 1

The operative arm was abducted by 70 to 90 degrees, turned externally, and the elbow was bent to 90 degrees, while antiseptic povidone iodine was applied to the place of the blocking injection. The probe was placed high in the axilla along the axillary crease, perpendicular to the biceps and the humerus, imaging the axillary artery in short axis, three nerves sit adjacent to the artery. The ulnar nerve is situated superficially between the axillary artery and vein, between 1 and 4 o'clock; the radial nerve is situated over the conjoint tendon of the teres major and latissimus dorsi, typically visible below the ulnar nerve between 4 and 6 o'clock. The median nerve is located between 9 and 12 o'clock position above the axillary artery and below the biceps muscle. The musculocutaneous nerve is located aside from the rest of the brachial plexus, between the coracobrachialis and the

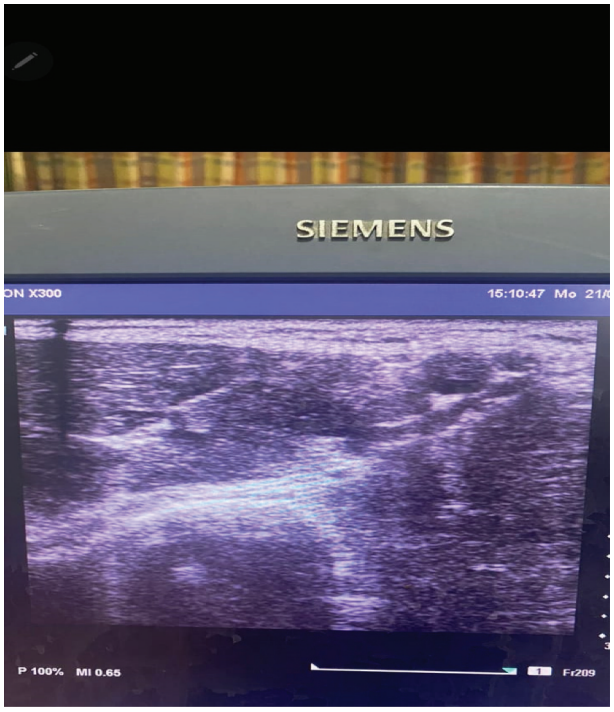

Figure 1. Sonoanatomy of axillary brachial plexus.

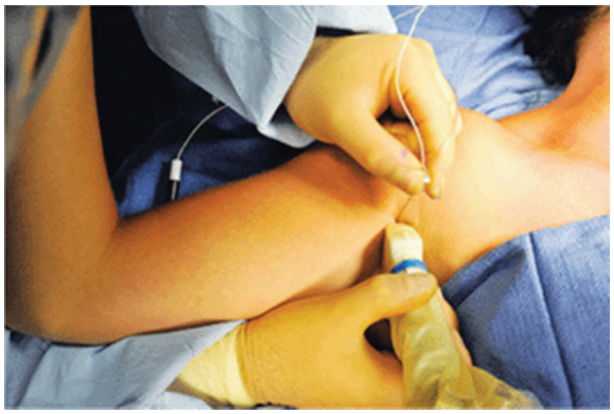

Figure 2. Probe position in the axilla.

biceps muscles or within the body of the coracobrachialis muscle. An in-plane technique was used, and a 22 gag needle on the probe's cephalic side was used to apply the block (Figure 2). Every moment of the needle was envisioned. Each group received two distinct amounts of local anesthesia in the same volume (0.5 ml/kg) of local anesthetic. Around every nerve, bupivacaine 0.19% and 0.25% were administered together with 1µg/kg of dexmedetomidine.

Axillary block performing time refers to the period of time between the needle's entry into the skin and the end of the injection.

The surgery was allowed to begin only after 20 min of finishing local anesthetic injection.

Following a skin incision, participants will not be included in the trial if their HR or mean arterial blood pressure increased by over 20% from the baseline value. This is referred to as block failure. When the block failed, 1–2 µg/kg of fentanyl was administered intravenously.

Neostigmine 0.05 mg/kg and atropine 0.02 mg/kg were used intravenously to counteract any remaining neuromuscular block after surgery. Paracetamol 15 mg/kg IV was administered to all patients.

2.4. Postoperative

Until complete recovery of motor function, attending anesthesiologist who was blinded to the research groups used the Modified Bromage scale to assess the motor function at the time of admission to the PACU, which is recorded as Bromage 0 then every 30 min for 3 h. Modified Bromage scale grading system includes grade 4 for complete muscular strength in the appropriate muscle groups, grade 3 for diminished strength but the ability for movement against resistance, grade 2 for the capacity to move against gravity but not against resistance, grade 1 for discrete motions (trembling), and grade 0 for inactivity.

The following muscles were used in the assessment of motor power: finger flexors to assess median nerve, finger adductors to assess Ulnar nerve, elbow flexion to assess musculocutaneous and finger extensors to assess Radial nerve.

Patients were evaluated for postoperative pain in the PACU and the ward using the (FLACC score) for Pain evaluation (Table 1) immediately after surgery as well as at the 1st, 4th, 8th and 12th hour post-surgery.

Each category was scored on the 0–2 scale, which results in a total score of (0–10).

Pethidine I.V. was administered as a rescue analgesic (1 mg/kg) when necessary for individuals with pain scores greater than 4/10, and total rescue analgesia was documented.

2.5. Measurement tools

Hemodynamic measurements were done on admission to the OR pre-induction, after induction, immediate post-skin incision, every 15 min till the end of surgery. Postoperative motor power recovery in the operating limb in each group was measured by admission to the PACU every 30 min for 3 h, postoperative pain, postoperative need for analgesia in each group were measured.

The primary outcome was incidence of motor power recovery utilizing Modified Bromage scale at admission to PACU, and secondary outcome(s) were assessing pain score on admission to the PACU then 1-, 4-, 8-, and 12-h postoperative,

postoperative total rescue analgesic consumption in each group, and intraoperative vital signs.

2.6. Sample size

A pilot study was done before starting this study on 10 patients because there are no available data in literature for mean and standard deviation (SD) of muscle power after axillary block in pediatrics using two different concentrations of bupivacaine using modified Bromage scale. The findings of the pilot work revealed a mean Bromage scale of 1.2 with SD 0.83 in the bupivacaine 0.25% group, the mean Bromage scale was 2 with SD 0.70 in the bupivacaine 0.19% group, A minimal sample size of 50 individuals (25 individuals in each group) was established using the G power software's unpaired t-test for independent samples and power analysis. These calculations were done utilising power 0.95 and alpha error 0.05. In order to account for potential dropouts, 60 individuals (with 30 individuals in each group) were enrolled.

2.7. Statistical analysis

SPSS version 22 was used to do the analysis on the data. The Kolmogorov–Smirnov test was used to determine whether the data were normally distributed. The chi-square test has been employed to conduct the analysis on the categorical data that was presented as frequency and percent. Normally distributed data was presented as mean ± SD and Student's T-Test was used for analysis of data, and abnormally distributed data was presented as median (interquartile range) and Mann–Whitney test was used in the analysis of data. *P* values lower than 0.05 were regarded to be statistically significant.

3. Results

Six patients were eliminated because they did not fulfill the inclusion criteria, leaving 60 patients who were divided equally among groups A and B and were available for the final analysis (Figure 3).

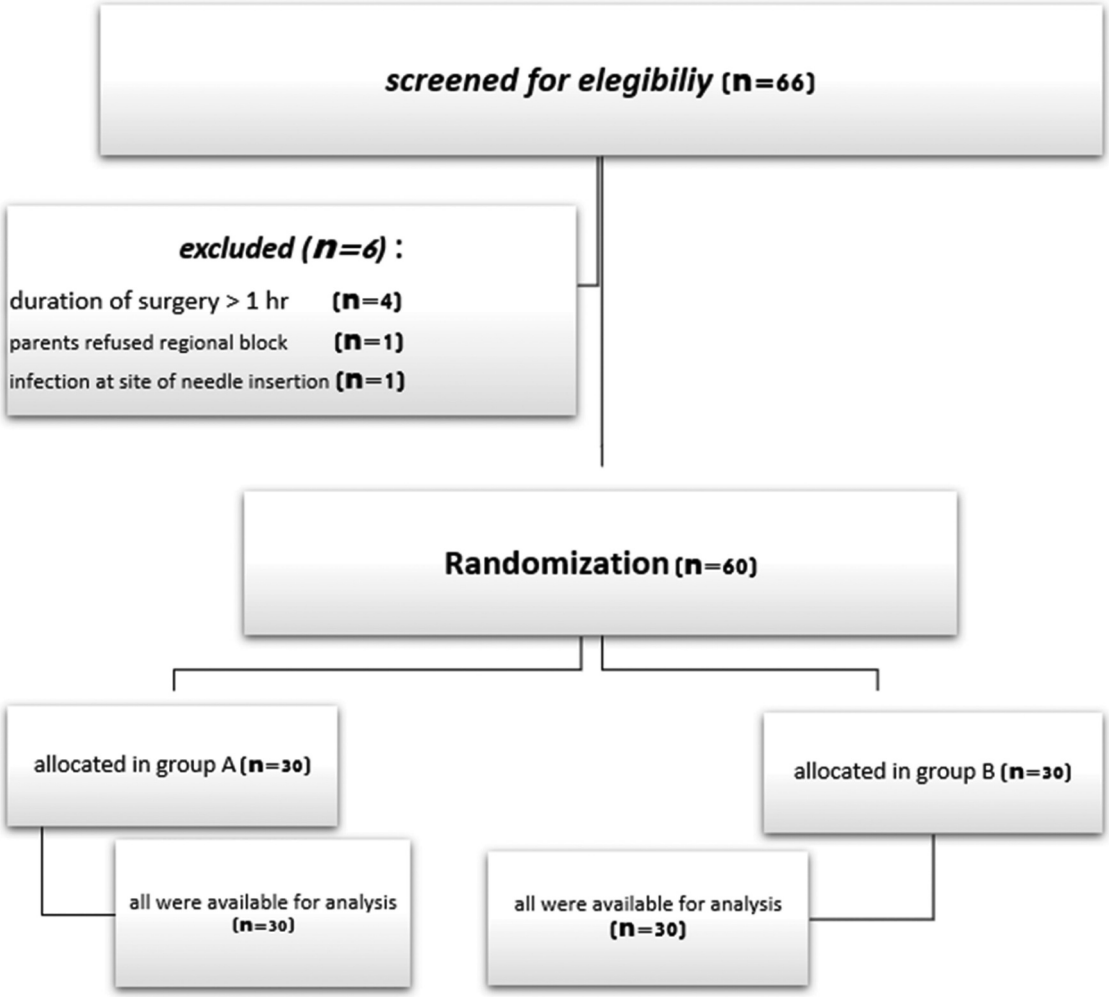

Figure 3. CONSORT flowchart of the studied patients.

Table 1. FLACC pain scale.

Categories	0	1	2
Face	No particular expression or smile	Occasional grimace or frown; withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs; frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort

Each category is scored on the 0–2 scale, which results in a total score of 0–10.
0: Relaxed and comfortable
1–3: Mild discomfort
4–6: Moderate pain
7–10: Severe discomfort or pain or both

Table 2. Patients demographic data in group (A) and group (B) (n = 60).

		Group A (n = 30)	Group B (n = 30)	P value
Age (years)		6.87 ± 2.52	6.00 ± 2.17	0.158
Weight (kg)		23.30 ± 7.35	23.47 ± 7.30	0.930
Sex	Female	17 (56.7%)	14 (46.7%)	0.438
	Male	13 (43.3%)	16 (53.3%)	

Data are expressed as mean ± standard deviation (Group A): 0.25% bupivacaine (Group B): 0.19% bupivacaine.

Table 3. Modified Bromage scale in group (A) and group (B) (n = 60).

	Group A (n = 30)	Group B (n = 30)	P value
Bromage (0)	2 (1, 2)	3 (2, 3)	<.001*
Bromage (30)	2 (2, 3)	3 (3, 3)	<.001*
Bromage (60)	3 (3, 3)	4 (3, 4)	<.001*
Bromage (90)	4 (3, 4)	4 (4, 4)	.104
Bromage (120)	4 (4, 4)	4 (4, 4)	1
Bromage (150)	4 (4, 4)	4 (4, 4)	1
Bromage (180)	4 (4, 4)	4 (4, 4)	1

Data are presented as median (IQR), *significant as P value < 0.05. Bromage: at time of admission to PACU, Bromage 0: after 30 min from admission to PACU, Bromage 60: after 60 min, Bromage 90: after 90 min, Bromage 120: after 120 min, Bromage 150: after 150 min, Bromage 180: after 180 min.

Table 4. FLACC score in group (A) and group (B) (n = 60).

	Group A (n = 30)	Group B (n = 30)	P value
FLACC O.	0 (0,0)	0 (0,0)	.317
FLACC 1st h	0 (0,0)	0 (0,0)	.317
FLACC 4th h	0 (0,0)	0 (0,1)	.015*
FLACC 8th h	0 (0,1)	1 (0,2)	.010*
FLACC 12th h	0 (0,1)	.5 (0,2)	.099

Data are presented as median (IQR), *significant as P value < 0.05. FLACC: Face, Legs, Activity, Cry, and Consolability scale. FLACC0: at recovery, FLACC 1st hour: after 1 h postoperative, FLACC 4th hour: after 4 h postoperative, FLACC 8th hour: after 8 h postoperative, FLACC 12th hour: after 12 h postoperative.

Patients' demographic data were insignificantly different between the studied groups (Table 2).

Regarding the Bromage scale, a highly substantial variation was recorded among the two groups in Bromage 0 till Bromage 60 with higher values in group (B), and no substantial variation was found in Bromage 90 till Bromage 180 between both groups (Table 3).

Table 4 shows no substantial variation among both groups regarding FLACC score in FLACC0 (immediately after recovery), 1st hour after recovery and 12th hour after recovery, and FLACC was significantly more ($p < 0.05$) in group B contrasted with group A in the 4th hour after recovery and 8th hour after recovery.

Regarding intra-operative heart rate, there was no statistically significant difference between the two groups (Figure 4).

Regarding intra-operative mean arterial blood pressure, there was no statistically significant difference between the two groups (Figure 5).

No patient in either group required rescue analgesia in the first 24-h postoperative.

4. Discussion

The main finding in this study illustrated that low concentrated group (0.19%) and high concentrated group (0.25%) have the same postoperative analgesic efficacy during first 4 h postoperatively; however, low concentrated group was associated with earlier regain of postoperative motor power.

Regarding the Bromage scale in our study, a highly substantial variation ($p < 0.05$) was recorded among both groups in Bromage 0 (immediately postoperative) till Bromage 60 (60-min postoperative) with higher values in group B, and there was no significant difference found in Bromage 90 (90-min postoperative) till Bromage 180 (180-min postoperative) between both groups.

According to FLACC score, the present work revealed no substantial variation ($p > 0.05$) between both groups in FLACC0 (immediately after recovery),

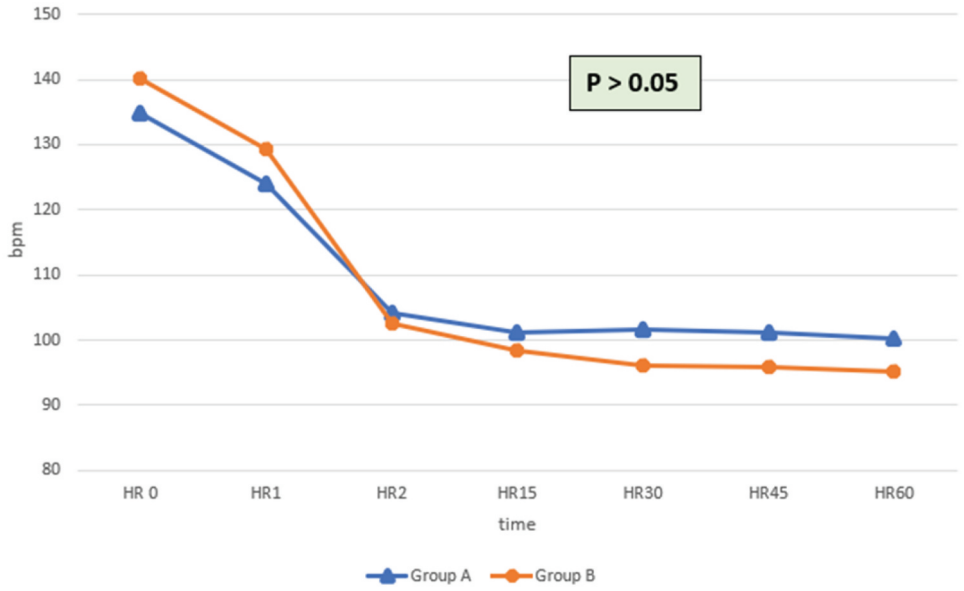

Figure 4. Intraoperative heart rate. HR0 = at time of admission to OR, HR1 = after induction, HR2 = after skin incision, HR15 = after 15 min. HR30 = after 30 min from skin incision, HR45 = after 45 minfrom skin incision, HR60 = after 60 min from skin incision.

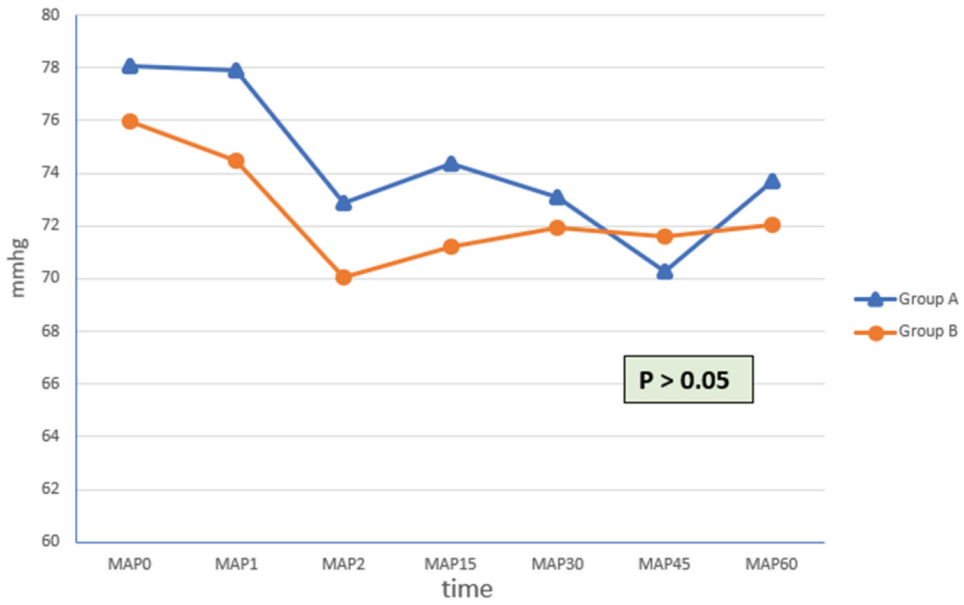

Figure 5. Intraoperative mean arterial blood pressure, MAP. MAP0 = at time of admission to OR, MAP1 = after induction, MAP2 = after skin incision, MAP15 = after 15 min. MAP30 = after 30 minutes from skin incision, MAP45 = after 45 min from skin incision, MAP60 = after 60 min from skin incision.

1st hour, after recovery and 12th hour, after recovery; substantial variation ($p < 0.05$) among both groups was revealed in FLACC 4th hour, after recovery and 8th hour, after recovery, with higher values in group B.

Alexandre Takeda et al. [6] used a step-up/step-down model to identify the MEC90 (minimum effective concentration) of bupivacaine that provides surgical anesthesia in adult between 18 and 65-year-old patients under sedation with midazolam in US-ABPB with peripheral nerve stimulator for proper nerve identification. The initial concentration of the local anesthetic was 0.35%. Based on the prior dosage, additional doses were calculated. The local anesthetic concentration for the following patient was either reduced or increased depending on whether the ABPB was successful or unsuccessful. If the motor scale was below or equal to 2, if all nerves did not experience pain or cold, and if more anesthesia (local or general) was not required during surgery, surgical anesthesia was deemed successful. The study showed that the MEC90 of bupivacaine was 0.241% [confidence interval: 0.20—0.34%]. No participant, with a successful blockade, noted pain following 4 h.

According to Alexandre Takeda [6] results, the minimum concentration of bupivacaine that provides motor blocks with Bromage score equal to

or less than 2 was 0.24%. They even measure the motor power earlier than us as they measure it 5–30 min post-local anesthesia injection. This is in line with our study that showed high statistically substantial variation between group A (0.25% bupivacaine) and group B (0.19% bupivacaine) in Bromage 0 till Bromage 60 with higher values in group (B).

Another trial of therapeutic blocks of nerves for upper extremity surgeries that spare the motor was done by Andres Missiar et al. [9], who studied the effect of lowering the volume of local anesthetic injected while maintaining the same concentration for Individuals who have upper limb surgical schedules, distally to the cubital fossa, whom underwent a supraclavicular nerve block with US-guidance, 15 mL of 1.5% mepivacaine was given to the low group and 30 mL of 1.5% mepivacaine was given to the high group. The motor block was evaluated 5–30 min after injection. The motor block, which was statistically significant between the two groups ($p < 0.01$) was observed in 55% of the individuals in Group HIGH vs 10% in Group LOW. However, there was no statistically significant difference between the two groups in the frequency of full sensory blocks [9].

The minimal effective amount of 0.5% bupivacaine for US-ABPB verified by peripheral nerve stimulator was established in a clinical experiment by Ferraro et al. [10]. Each trunk received an initial injection of 5 mL of 0.5% bupivacaine mixed with 1:200,000 epinephrine. The amount of local anesthetic for the subsequent patient was either decreased or increased depending on whether the blockage was successful.

Effective blockage was defined as the absence of temperature sensitivity, reaction to pinprick in the areas of the median, ulnar, musculocutaneous, and radial nerves, and motor function of grade 2 on the modified Bromage scale. Furthermore, to verify the efficacy of the anesthetic technique, the surgery needs to be performed without extra analgesics.

For an ultrasound-guided brachial plexus blockage, the MEV90 (minimum effective volume) of 0.5% bupivacaine with 1:200,000 epinephrine was 1.56 mL (95% confidence interval [CI]: 0.99–3.5). Every person in whom the blockage became effective had surgery without incident, and no extra anesthesia was required. As for analgesia following surgery, nobody complained of discomfort for the first 3 h after the blockage. This may be as a result of using a mixture of 0.5% and 1:200,000 epinephrine.

In an ultrasound-guided femoral nerve block after an arthroscopic knee meniscectomy, ED Carlos Rey Moura et al. [11] investigated the minimal effective concentration of bupivacaine, with the first participant receiving 22 mL of 0.25% bupivacaine. Bupivacaine dosage was raised for the following individual by 0.05% in the event that the prior patient had a poor reaction. If the preceding patient had a favourable outcome, the following case would at random either get the same dose of bupivacaine or a concentration that was 0.05% lower.

A numerical pain intensity score of 4 or less at time points T0 (at waking), T1 (after 1 h), and T2 (after 2 h); the need for intraoperative remifentanil; the length of time it took before the initial analgesic was added; and the total amount of added analgesia within the first 2 h following surgery. The numerical pain score and the Bromage scale were measured.

Bupivacaine was injected at concentrations of 0.15% (3.8% of patients), 0.20% (21.2%), 0.25% (30.8%), 0.33% (28.8%), and 0.35% (15.4%). According to various bupivacaine concentrations, there was no variation in the ratings for pain severity. In terms of 95% confidence intervals, the MEC50 was 0.160 and the MEC90 was 0.271.

When comparing bupivacaine concentrations of >0.30% to 0.20%, the duration until the need for analgesics supplement was substantially prolonged; there was no substantial variation when comparing 0.20% to 0.25% and 0.25% to >0.30%. Two individuals in the trial group who had motor blockades following the surgery with Bromage scores below 1 and durations of 240 and 600 min were reported [11].

Ivani et al. [12] studied the effects of three distinct concentrations of levobupivacaine on caudal blockade (0.125%, 0.20%, and 0.25%). The level of motor blockade was measured using a straightforward 3-point scale (0 = no movements, 1 = ability to move the legs, and 2 = ability to stand), and the pain was measured using the CHIPPS score. Each was evaluated every 30 min for the first 4 h, hourly for the next 16 h, and then every 2 h while awake until the conclusion of the period of observation.

Regarding the median postoperative analgesic duration, it was 0.125%, 60 min; 0.20%, 118 min; 0.25%, 158 min, which is in contrast to our results that showed the same postoperative analgesic effect in the first 4-h postoperative and the frequency of participants with proof of early postoperative motor blockage (0.125%, on recovery; 0.20%, 4h; 0.25%, 8h), this is in contrast to our results that showed complete regain of motor power in 0.25 group after 2 h and in 0.19 group after 1 h. The postoperative analgesia' duration proved to be substantially reduced at the 0.125% dose, although it was linked with much less early motor blockage. Based on these findings, the consumption of 0.20% levobupivacaine may be the optimum therapeutic choice for caudal blocking in children when using a basic levobupivacaine solution [12].

Joel B Gunter et al. [13] used six concentrations of bupivacaine (0.125, 0.15, 0.175, 0.2, 0.225, 0.25) for

caudal anesthesia from in children scheduled for unilateral or bilateral hernorrhaphy. They compared these concentrations to determine which would provide effective intraoperative anesthetic supplementation combined with minimization of distressing side effects and rapid emergence from anesthesia and early home discharge.

The incidence of paresthesia and leg weakness were positively correlated with bupivacaine concentration.

They came to the conclusion that 0.175 bupivacaine provides the optimum efficiency, quick recovery, and home discharge combinations [13].

In pediatric caudal anesthesia for major abdominal cancer procedures, Fares et al. [14] investigated the effects of combining dexmedetomidine 1 µg/kg to 0.25% bupivacaine. Two groupings were created from them: Group A received 1 mL/kg of bupivacaine 0.25% along with 1 µg/kg of dexmedetomidine, while group B received the same bupivacaine concentration but with 1 mL/kg of saline as a placebo. The FLACC score was used to measure pain immediately after surgery as well as at hours 2, 4, 6, 12, 18, and 24. Both the first-time analgesia was requested, and the total amount of analgesics used in the initial 24 h was noted. Ramsay's sedation scale was used to measure the degree of drowsiness.

At 2, 4, 6, and 12 h after surgery, group A showed a substantial decrease in FLACC score compared to group B. There was no discernible change between 18th and 24th hours. When contrasted to group B, group A experienced much longer time before the first rescue analgesic was needed. When group A was contrasted to group B, the mean total amount of rescue analgesia consumed within the first 24 h after surgery was considerably lower in group A. Although statistically substantial, hemodynamic alterations had little clinical relevance [14].

5. Limitations

(1) Using dexmedetomidine as an adjuvant may affect and prolong anesthesia.
(2) We compared between two concentrations of bupivacaine only (0.19% and 0.25%), further research is needed to examine the impact of other concentrations of bupivacaine.

6. Recommendations

Use a lower concentration of local anesthetics to allow early recovery of motor power.

Future research is needed to establish the lowest-effective amount and concentration of local anesthetics for pediatric patients under the age of four who are undergoing US-guided peripheral nerve blocks.

7. Conclusions

Using a lower concentration of bupivacaine (0.19%) plus dexmedetomidine (1 µg/kg) in US-ABPB was associated with regain of postoperative motor power with the same postoperative analgesic efficacy compared to standard concentration (0.25%) bupivacaine plus dexmedetomidine (1 µg/kg) in the early postoperative period.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

[1] Sasongko H, Sukartini T, Wahyuni ED, et al. The effects of combination of range motion and deep breathing exercise on pain in post-orthopedic surgery patients. INDONES J MED. 2019;4(1):46–53. doi: 10.26911/theijmed.2019.04.01.08
[2] Oke AO, Martin C. Regional anesthesia in children in the acute surgical setting. In: Verghese S Kane T, editors Anesthetic management in pediatric general surgery: evolving and current concepts. Cham: Springer International Publishing; 2021. pp. 263–277.
[3] Merella F, Mossetti V. Ultrasound-guided upper and lower extremity nerve blocks in children. BJA Educ. 2020;20(2):42–50. doi: 10.1016/j.bjae.2019.11.003
[4] Kim DH, Kim SJ, Wetmore DS. Postoperative pain management in the orthopedic setting. In: MacKenzie C, Cornell C Memtsoudis S, editors Perioperative care of the orthopedic patient. Cham: Springer International Publishing; 2020. pp. 129–141.
[5] Chesham RA, Shanmugam S. Does preoperative physiotherapy improve postoperative, patient-based outcomes in older adults who have undergone total knee arthroplasty? A systematic review. Physiother Theory Pract. 2017;33(1):9–30. doi: 10.1080/09593985.2016.1230660
[6] Takeda A, Ferraro LHC, Rezende AH, et al. Concentração mínima efetiva de bupivacaína para o bloqueio do plexo braquial via axilar guiado por ultrassom. Braz J Anesthesiol. 2015;65(3):163–169. doi: 10.1016/j.bjan.2013.11.007
[7] Ponde V. Recent trends in paediatric regional anaesthesia. Indian J Anaesth. 2019;63(9):746–753. doi: 10.4103/ija.IJA_502_19
[8] Allman K, Wilson I, O'Donnell A, et al. Oxford handbook of anaesthesia. Oxford University Press: 2016. doi:10.1093/med/9780198719410.001.0001
[9] Missair A, Osman BM, Palte HD, et al. Motor-sparing surgical nerve blocks for upper extremity surgery: significantly less motor paralysis using 15 mL versus 30 mL of mepivacaine 1.5% for supraclavicular block-A prospective randomized double-blinded study. Orthop Muscular Syst. 2017;06(01):6. doi: 10.4172/2161-0533.1000231

[10] Ferraro LH, Takeda A, dos Reis Falcão LF, et al. Determinação do volume mínimo efetivo de bupivacaína 0,5% para bloqueio do plexo braquial por via axilar guiado por ultrassom. Braz J Anesthesiol. 2014;64(1):49–53. doi: 10.1016/j.bjan.2013.03.014

[11] Moura EC, de Oliveira Honda CA, Bringel RC, et al. Minimum effective concentration of bupivacaine in ultrasound-guided femoral nerve block after arthroscopic knee meniscectomy: a randomized, double-blind, controlled trial. Pain Physician. 2016;19: E79–86. doi: 10.36076/ppj/2016.19.E79

[12] Ivani G, De Negri P, Lonnqvist PA, et al. A comparison of three different concentrations of levobupivacaine for caudal block in children. Anesth Analg. 2003;97(2):368–371. doi: 10.1213/01.ANE.0000068881.01031.09

[13] Gunter JB, Dunn CM, Bennie JB, et al. Optimum concentration of bupivacaine for combined caudal–general anesthesia in children. Anesthesiology. 1991;75(1):57–61. doi: 10.1097/00000542-199107000-00010

[14] Fares KM, Othman AH, Alieldin NH. Efficacy and safety of dexmedetomidine added to caudal bupivacaine in pediatric major abdominal cancer surger. Pain Physician. 2014;17(5;9):393–400. doi: 10.36076/ppj.2014/17/493