Brief Report

Cervical plexus anesthesia for carotid endarterectomy: comparison of ropivacaine and mepivacaine

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Purpose: To evaluate the effectiveness of cervical plexus block performed with ropivacaine 0.75% or 1%, or mepivacaine 2%.

Methods: In a prospective, randomized, double-blind study, 60 patients received deep cervical plexus block with 0.2 ml·kg^{-1} divided among C_2-C_4 injections using ropivacaine 0.75% and 1% or mepivacaine 2%. A blinded observer recorded loss of pin-prick sensation every minute in the C_2-C_4 dermatomes until readiness for surgery. Then, a superficial cervical block was performed with 0.15 ml·kg^{-1} lidocaine 1%. The need for intraoperative supplemental analgesia and degree of pain and time of first postoperative pain medication were also recorded.

Results: General anesthesia was not required to complete surgery in any case. No differences in the need for intraoperative supplemental analgesia was observed (7, 6, and 9 patients with ropivacaine 0.75% and 1% or mepivacaine 2%, respectively). Readiness to surgery required 15 (10 - 25) min with ropivacaine 0.75%, 18 (8 - 20) min with ropivacaine 1%, and 15 (5 - 20) min with mepivacaine 2% (P = NS); while patients asked for first postoperative pain medication after 10 (4 - 13) hr and 9 (6.5 - 11) hr with ropivacaine 0.75% and 1% compared with 5 (0 - 8) hr with mepivacaine 2% ($P < 0.05$).

Conclusion: Ropivacaine 0.75% or 1% are appropriate choices when performing cervical plexus anesthesia for carotid endarterectomy, providing nerve block characteristics similar to those of mepivacaine 2%, but with the advantage of longer postoperative pain relief.

Objectif : Évaluer l'efficacité du blocage du plexus cervical réalisé avec de la ropivacaïne 0,75 % ou 1 %, ou de la mépivacaïne 2 %.

Méthode : Lors d'une étude prospective, randomisée et à double insu, 60 patients ont reçu un blocage profond du plexus cervical avec 0,2 ml·kg^{-1} divisé en injections C_2-C_4 de ropivacaïne 0,75 % et 1 % ou de mépivacaïne 2 %. Un observateur impartial a enregistré la perte de sensation à la piqûre à chaque minute dans les dermatomes de C_2-C_4 jusqu'à l'insensibilité nécessaire à l'opération. Un blocage cervical superficiel a ensuite été réalisé avec 0,15 ml·kg^{-1} de lidocaïne 1 %. Les besoins d'analgésie d'appoint peropératoire et le degré de la douleur ainsi que le moment de la première demande postopératoire d'analgésique ont aussi été notés.

Résultats : Aucun patient n'a eu besoin d'anesthésie générale pendant l'intervention chirurgicale. Aucune différence d'analgésie supplémentaire peropératoire n'a été observée (7, 6, et 9 patients avec la ropivacaïne 0,75 % et 1 % ou la mépivacaïne 2 %, respectivement). Pour être prêt à l'opération, il a fallu 15 (10 - 25) min avec la ropivacaïne 0,75 %, 18 (8 - 20) min avec la ropivacaïne 1 %, et 15 (5 - 20) min avec la mépivacaïne 2 % (P = NS); les patients ont demandé une première dose d'analgésie postopératoire après 10 (4 - 13) h et 9 (6,5 - 11) h avec la ropivacaïne 0,75 % et 1 % en comparaison de 5 (0 - 8) h avec la mépivacaïne 2 % ($P < 0,05$).

Conclusion : La ropivacaïne 0,75 % ou 1 % constitue un bon choix pour réaliser une anesthésie du plexus cervical lors d'une endartériectomie carotidienne, les caractéristiques du blocage nerveux étant similaires à celles de la mépivacaïne 2 %, mais comportant l'avantage d'un soulagement prolongé de la douleur postopératoire.

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WHEN performing cervical plexus anesthesia for carotid endarterectomy a 1:1 lidocaine-bupivacaine mixture or mepivacaine is often used to produce fast onset and intermediate duration nerve blockade.[1,2] Ropivacaine is a new, long-acting local anesthetic,[3] but little is known about its use in deep cervical plexus anesthesia. This prospective, randomized, double-blind study was designed to compare ropivacaine 0.75% and 1% with mepivacaine 2% when performing deep cervical plexus anesthesia for carotid endarterectomy.

Materials and methods

With Ethical Committee Approval and informed, written, patient consent, 60 patients receiving cervical plexus anesthesia for elective carotid endarterectomy were studied. A pilot study with eight patients per group had been performed previously to calculate the estimated sample size (we wished to detect a five minute difference in the time required to achieve adequate surgical anesthesia between mepivacaine 2% and ropivacaine 0.75% or 1%, accepting a two-tailed error of 5%, and a ß error of 10%,[4])

All patients received 0.05 mg·kg^{-1} midazolam *iv* premedication 15 min before block placement followed by 0.5 mg atropine *im*. Then, standard monitoring was applied (including continuous arterial blood pressure through a radial artery catheter), and patients were randomly divided (sealed envelopes technique) into three groups of 20 patients to receive deep cervical plexus anesthesia with 0.2 ml·kg^{-1} of ropivacaine 0.75% and 1% or mepivacaine 2%. After sterile syringes had been prepared in a double-blinded fashion by one of the authors not taking further part in patient management, deep cervical plexus block was performed using a three injection technique at the C_2, C_3, and C_4 levels[5] by one of four attending anesthesiologists with extensive expertise in deep cervical plexus block (SM, GM, GG, or A.L). The total amount of local anesthetic solution to be injected was equally divided among the three injection sites.

A blinded, trained observer (AR or FM) evaluated the patient every minute until loss of pinprick sensation in the C_2-C_4 dermatomes (readiness to surgery). Then, a superficial cervical block was performed with 0.15 ml·kg^{-1} lidocaine 1%.[5] If the patient complained of pain during surgery, supplemental lidocaine 1% was administered superficially (into the skin and subcutaneous tissues) or deep (into and around the carotid sheath) by the surgeon, who was blinded to patient grouping. If this proved to be ineffective, 1 µg·kg^{-1} fentanyl *iv* was given, hopefully avoiding interference with patient communication to assess his/her neurological status. Needs for anesthetic and analgesic supplementation were also recorded. Nitrate or etilephrine were given intraoperatively as required by the surgical procedure, and their total consumption was recorded.

Postoperative analgesia consisted of 100 mg ketoprofen *iv prn*. Postoperative pain relief was defined as the time lasting from block placement to the first request for postoperative pain medication. The degree of pain at first pain medication request was also measured on a 100 mm visual analogue scale (VAS).

Statistical analysis was performed using the program Systat 7.0 (SPSS Inc, Chicago, IL). The Kruskall-Wallis test and the Mann-Whitney U- test with Bonferroni's correction were used to analyze continuous variables. Categorical data were analyzed using the contingency table analysis with the Fisher exact test. A value of $P < 0.05$ was considered significant. Results are presented as median (range), or as number (%).

Results

No differences in patient age, weight, height, and male/female ratio were observed between studied groups (Table I). No signs of central nervous system (CNS) or cardiovascular toxicity, or other untoward events were reported in any patient. The injected doses of local anesthetic solution were 100 ± 18 mg with ropivacaine 0.75% , 137 ± 25 mg with ropivacaine 1% , and 275 ± 41 mg with mepivacaine 2%. Table II shows onset times of deep cervical plexus anesthesia as well as total intraoperative consumption of lidocaine 1%, intravenous fentanyl, nitrate and fenilephrine. General anesthesia was not required to complete surgery in any case, and no differences in the need for block supplementation were observed among the three groups.

No differences in the degree of pain as measured with the visual analogue scale were observed at time of first analgesic administration (31 ± 30 mm, 24 ± 26 mm, and 26 ± 30 mm after ropivacaine 0.75%, and 1% or mepivacaine 2%, respectively). However, postoperative pain relief was longer in patients receiving ropi-

TABLE I Demographic data.

	Ropivacaine$_{0.75\%}$ *(n = 20)*	*Ropivacaine$_{1\%}$* *(n = 20)*	*Mepivacaine* *(n = 20)*
Age (yr)	70 (53 - 83)	70 (54 - 82)	72 (53 - 84)
Weight (kg)	64 (50 - 93)	66 (50 - 92)	70 (50 - 95)
Height (cm)	163 (155 - 175)	167 (150 - 178)	165 (155 - 182)
Sex (Male/Female)	10 / 10	15 / 5	14 / 6

Data are presented as median (range), except for sex (number).

TABLE II Time required for onset of deep cervical plexus anesthesia, and total intraoperative consumption of supplemental lidocaine and fentanyl, nitrate, and fenilephrine after cervical plexus anesthesia performed with either 0.75%, 1% ropivacaine, or 2% mepivacaine.

	Ropivacaine$_{0.75\%}$ *(n = 20)*	*Ropivacaine*$_{1\%}$ *(n = 20)*	*Mepivacaine (n = 20)*
Onset of Deep Cervical Block (min)	15 (10 - 25)	18 (9 - 20)	15 (5 - 20)
Intraoperative Lidocaine 1% consumption (ml)	7 (0 - 30)	5 (0 - 25)	9 (0 - 30)
Intraoperative Fentanyl consumption (mg)	0 (0 - 0.15)	0 (0 - 0.05)	0 (0 - 0.1)
Intraoperative Nitrate consumption (mg)	2 (0 - 6)	2 (0 - 8)	2 (0 - 15)
Intraoperative Fenilephrine consumption (mg)	1 (0 - 8)	0 (0 - 2)	1 (0 - 5)

Data are presented as median (range).

vacaine 0.75% (10 hr; range 4 - 13 hr) and 1% (9 hr; range 6.5 - 11 hr) than in patients receiving mepivacaine 2% (5 hr; range 0 - 8 hr) ($P < 0.05$).

Discussion

This prospective, randomized, double-blind study suggested that, when used at the same volume to perform deep cervical plexus anesthesia, ropivacaine 0.75% or 1% are as effective as mepivacaine 2%, with the advantage of prolonged postoperative analgesia. Based on previous experience of ropivacaine use in different peripheral nerve blocks,[6,7] these findings could have been predicted. However, we were unaware of previous investigations comparing different ropivacaine concentrations with mepivacaine 2% for deep cervical plexus anesthesia. Bupivacaine might appear more appropriate than mepivacaine as a control drug, due to its pharmacokinetic properties, but mepivacaine is routinely used in our Department for deep cervical plexus anesthesia, because of its short latency and is the reason for our choice.

To minimize the risk of overdosing local anesthetics due to the combination of deep and superficial blocks,[8] a mixture of two different local anesthetics was used for the two different blocks, with a delay between deep and superficial blocks placement. However, plasma concentrations of local anesthetics may reach near the toxic threshold during cervical plexus anesthesia,[9] and usual recommendations like multiple aspiration and slow injection must be emphasized.

The consumption of intraoperative anesthetic/analgesic supplementation observed using the three injection technique at C_2-C_4 is similar to that reported by Stoneham *et al.*[10] when performing deep cervical plexus anesthesia using a single injection technique at C_4.

In conclusion, this randomized double-blind study demonstrated that ropivacaine 0.75% and 1% are suitable choices when performing cervical plexus anesthesia for carotid endarterectomy, providing nerve block characteristics similar to those of mepivacaine 2%, with the advantage of a longer postoperative pain relief.

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