Magnesium added to bupivacaine prolongs the duration of analgesia after interscalene nerve block

Le magnésium ajouté à la bupivacaine prolonge la durée de l'analgésie après un bloc interscalénique

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Abstract

Purpose Local anesthetic adjuvants have been studied previously in an attempt to prolong the duration of analgesia after peripheral nerve blockade. Magnesium has been shown to have an antinociceptive effect in animal and human pain models. We evaluated the effects of adding magnesium sulphate to long-acting local anesthetics for interscalene nerve block to prolong the duration of analgesia and improve the analgesic quality.

Methods We enrolled 66 patients undergoing arthroscopic rotator cuff repair. The interscalene nerve block was performed with 0.5% bupivacaine 20 mL with epinephrine (1:200,000) plus either 10% magnesium sulphate 2 mL (Magnesium Group) or normal saline 2 mL (Saline Group). The following data were recorded for 24 hr after surgery: onset times and durations of sensory and motor blocks, analgesic duration, the pain numeric rating scale (NRS), postoperative fentanyl consumption, and complications.

Results The duration of analgesia was longer in the Magnesium Group than in the Saline Group [mean and (standard deviation) 664 (188) min vs 553 (155) min, respectively; $P = 0.017$]. Patients in the Magnesium Group had significantly reduced pain NRS scores at 12 hr ($P = 0.012$), but the cumulative fentanyl consumption was

similar in both groups. The onset times and durations of sensory and motor blocks were not significantly different between the two groups.

Conclusion The addition of magnesium sulphate to a bupivacaine-epinephrine mixture for interscalene nerve block prolongs the duration of analgesia and reduces postoperative pain.

Résumé

Objectif Des adjuvants aux anesthésiques locaux ont déjà été étudiés dans l'espoir de prolonger la durée de l'analgésie après un bloc nerveux périphérique. Il a été démontré que le magnésium a un effet antinociceptif dans des modèles de douleur sur l'animal et chez l'homme. Nous avons évalué les effets de l'addition de sulfate de magnésium à des anesthésiques locaux à longue durée d'action pour le bloc interscalénique quant à la prolongation de l'analgésie et l'amélioration de sa qualité.

Méthodes Nous avons recruté 66 patients devant subir une réparation de la coiffe des rotateurs par voie arthroscopique. Le bloc interscalénique a été réalisé avec 20 mL de bupivacaine à 0,5 % et épinéphrine (1 :200 000) plus 2 mL de sulfate de magnésium à 10 % (groupe magnésium) ou 2 mL de sérum physiologique normal (groupe témoin). Les données suivantes ont été enregistrées 24 h après l'intervention : délais d'apparition et durées des blocs sensitif et moteur, durée de l'analgésie, échelle d'évaluation numérique de la douleur, consommation postopératoire de fentanyl et complications.

Résultats La durée de l'analgésie était plus longue pour le groupe magnésium que pour le groupe témoin [respectivement : moyenne et (écart type) de 664 188 min, contre 553 min et un (155) min; $p = 0,017$]. Les valeurs sur l'échelle numérique de douleur étaient significativement plus basses chez les patients du groupe

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magnésium à 12 heures; $P = 0,012$), mais la consommation cumulée de fentanyl était semblable dans les deux groupes. Il n'y avait pas de différences significatives entre les deux groupes pour les délais d'apparition et la durée des blocs sensitif et moteur.

Conclusion L'adjonction de sulfate de magnésium à un mélange bupivacaïne-épinéphrine pour les blocs interscaléniques prolonge la durée de l'analgésie et diminue la douleur postopératoire.

Interscalene nerve block is one of the techniques most commonly used for postoperative analgesia following shoulder surgery, and it has the potential benefit of reducing intra-articular bleeding and providing visual clarity during the surgical procedure.¹ Following arthroscopic shoulder surgery, patients report severe pain on the first postoperative day after the effect of local anesthetics has worn off. Therefore, prolonging the duration of local anesthetics is desirable for decreasing postoperative pain and improving patients' satisfaction. A number of local anesthetic adjuvants, such as alpha-2 adrenergic agonists,^{2,3} ketamine,⁴ and corticosteroids,⁵ have been evaluated for their abilities to prolong the analgesic duration of brachial plexus blocks, and results have varied. Clonidine added to intermediate or long-acting local anesthetics for peripheral nerve block has been reported to prolong the duration of analgesia, sensory block, and motor block by about two hours. However, the increased risk of hypotension, fainting, and sedation may limit its usefulness.² The addition of dexamethasone to bupivacaine and clonidine has been shown to prolong the analgesic duration of brachial plexus blocks. This effect may be secondary to a local action of dexamethasone on nociceptive C-fibre mediated via glucocorticoid receptors and anti-inflammatory action.⁵ Ketamine added to ropivacaine for brachial plexus block did not improve analgesia but increased the frequency of adverse effects, such as hallucinations, drowsiness, and unpleasant feelings.⁴ The controversial effects of the adjuvants and drug specific side effects limit their routine application.

Magnesium has been shown to have antinociceptive effects in animal and human models by blocking the N-methyl-D-aspartate (NMDA) receptor and associated calcium channels, thus preventing central sensitization caused by peripheral nociceptive stimulation.⁶ The addition of magnesium sulphate to local anesthetics for neuraxial anesthesia prolongs the duration of anesthesia and improves quality of analgesia.⁷⁻⁹ However, there are few clinical studies on the addition of magnesium for peripheral nerve blocks. Gunduz *et al.*¹⁰ found that the addition of magnesium sulphate to 2% prilocaine for axillary brachial

plexus block provided marked prolongation of sensory and motor blockades. They showed an important interaction between magnesium and local anesthetics on peripheral nerve blocks. It is unclear whether this prolongation would apply to longer acting local anesthetics.

We conducted a clinical study to investigate the effects that adding magnesium sulphate to long-acting local anesthetics (i.e., bupivacaine with epinephrine) would have on the durations of sensory and motor blocks and on the analgesic qualities of interscalene nerve blocks in patients undergoing arthroscopic rotator cuff repair.

Methods

This prospective randomized trial was approved by the review board of Samsung Medical Center, Seoul, Korea (number 2008-11-036-001), and all subjects provided written, informed consent. The study included 66 patients who were American Society of Anesthesiologists' physical status I or II, aged 37-73 yr, and scheduled for arthroscopic rotator cuff repair from December 2008 to July 2009. Exclusion criteria included a history of cardiac, hepatic, or renal disease; chronic treatment with calcium channel blocker; hypermagnesemia; contraindications to interscalene nerve block (bleeding disorders, local or systemic infection); and inability to comprehend the numeric rating scale (NRS) for pain assessment.

The patients were randomly allocated into two groups using computer-generated sequence numbers. Patients in the Magnesium Group received 0.5% bupivacaine 20 mL (1:200,000 epinephrine) plus 10% magnesium sulphate 2 mL, and patients in the Saline Group received 0.5% bupivacaine 20 mL (1:200,000 epinephrine) plus normal saline 2 mL. All local anesthetic solutions were prepared immediately before administration by one of the authors not involved in either performing the interscalene nerve block or collecting data. Upon arrival in the preoperative regional block room, standard monitoring was applied and patients were administered midazolam 0.02 mg·kg⁻¹ *iv* before the procedure. During the procedure, the patients were placed in the supine position with their head turned away from the side to be blocked. We used ultrasound (M-turbo®, Sonosite, Washington, DC, USA) to identify the brachial plexus at the level of the roots/trunk between the anterior and middle scalene muscles. After local infiltration of the skin at the point of needle insertion, a sterile 50 mm 22G insulated needle (Stimuplex®, Bon. Braun, Melsungen, Germany) was advanced using an in-plane technique, while a nerve stimulator was used simultaneously for precise localization of the needle. After an output current of < 0.5 mA elicited a slight distal motor response in muscles (deltoid, lateral pectoralis, biceps, or triceps), the local anesthetic

solution was administered in increments with a negative aspiration test for blood, while the spread of local anesthetic around the brachial plexus was observed under real-time ultrasound guidance. The time corresponding to the end of local anesthetic administration was recorded as the baseline for the time interval. All of the interscalene nerve blocks were performed by a single anesthesiologist who was experienced in this technique and blinded to group allocation. The study data were recorded by a researcher who was blinded to the patient groups.

Patients were evaluated every minute until 30 min after the end of local anesthetic injection by the anesthesiologist who performed the interscalene nerve block and was blinded to group allocation. Sensory block was assessed by pinprick test using a three-point scale in the C4 and C5 sensory dermatome distribution and compared with the contralateral arm as a reference: 0 = normal sensation; 1 = loss of sensation of pinprick (analgesia); and 2 = loss of sensation of touch (anesthesia). Motor block was assessed according to shoulder movement using a three-point scale: 0 = normal movement; 1 = diminished but not totally absent motor strength (paresis); and 2 = unable to elevate the arm (lack of movement). The onset times of the sensory and motor blockades were defined as the time interval between the end of local anesthetic administration and the loss of sensation to pinprick (sensory score = 1) and absent movement (motor score = 2), respectively. After surgery, an anesthetic nurse, who was blinded to patient allocation, evaluated the patients every ten minutes until complete resolution of sensory and motor blockade. The duration of sensory block was defined as the time interval between the end of local anesthetic administration and restoration of normal sensation (i.e., sensory score 0 compared with the contralateral arm as a reference). The duration of motor block was defined as the time interval between the end of local anesthetic administration and the recovery of complete motor function.

Block success was defined as loss of sensation to pinprick (sensory score ≥ 1) in the C4 and C5 sensory dermatome distributions measured 30 min after the end of local anesthetic injection. At the discretion of the attending anesthesiologist, a supplemental rescue nerve block could be performed for patients in whom block success was not achieved after 30 min, and the patient would then be excluded from data analysis.

After confirmation of successful sensory and motor blocks, the patient was taken to the operating room and general anesthesia was induced with thiopental sodium $5 \text{ mg} \cdot \text{kg}^{-1}$ and rocuronium $0.6 \text{ mg} \cdot \text{kg}^{-1}$. Anesthesia was maintained with sevoflurane and 1:1 O_2/air after tracheal intubation. A single surgeon performed arthroscopic rotator cuff repair surgeries with the patient in the lateral decubitus position.

Heart rate and mean blood pressure during surgery were recorded at zero, ten, 20, 30, 45, 60, 75, 90, 105, and 120 min. When the mean blood pressure decreased by $> 20\%$ in relation to baseline, ephedrine 5 mg iv was administered. Bradycardia was defined as a decrease in heart rate to $< 60 \text{ beats} \cdot \text{min}^{-1}$, and atropine 0.5 mg iv was administered in cases where the heart rate was $< 45 \text{ beats} \cdot \text{min}^{-1}$. When the mean blood pressure increased by $> 20\%$ in relation to baseline, remifentanyl $0.1 \mu\text{g} \cdot \text{kg}^{-1}$ was administered intravenously. At the end of surgery, pyridostigmine 15 mg and glycopyrrolate 0.4 mg were used to reverse residual neuromuscular blockade. Once all four twitches were visible in response to train-of-four stimulation, the patients were transferred to the postanesthetic care unit (PACU). The time interval from the end of surgery to tracheal extubation was recorded, as was the duration of stay in the PACU.

Postoperative pain was measured using a numeric rating scale (NRS, from 0 = no pain to 100 = worst pain ever experienced) at four, eight, 12, and 24 hr after the end of surgery. The patients were instructed to use the intravenous patient-controlled analgesia (PCA) device whenever they felt pain (NRS ≥ 40) and to call the nurse to document both the time the PCA was first administered and the pain NRS at that time. The duration of analgesia was defined as the time interval between the end of local anesthetic administration and the first administration of a PCA dose. The PCA device was set as follows: fentanyl concentration at $15 \mu\text{g} \cdot \text{mL}^{-1}$ and bolus dose of $15 \mu\text{g}$ with a ten-minute lockout interval.

Supplemental postoperative analgesia was standardized. Meperidine $0.5 \text{ mg} \cdot \text{kg}^{-1}$ was administered intravenously as a rescue analgesic when the patient complained of intolerable pain (NRS ≥ 40) in spite of using PCA. Patients received oral analgesics (zaltoprofen 80 mg) three times a day from the day after surgery. Upon discharge from hospital, patients received fentanyl patches $25 \mu\text{g} \cdot \text{hr}^{-1}$ as needed.

The cumulative fentanyl consumption was recorded at four, eight, 12, and 24 hr postoperatively. Sedation was assessed on a four-point scale at four, eight, 12, and 24 hr postoperatively: 0 = awake and alert; 1 = mildly sedated, aroused by verbal commands; 2 = moderately sedated, aroused by shaking; 3 = deeply sedated, difficult to arouse by physical stimulation. Adverse events, such as hypotension, bradycardia, nausea, vomiting, and pruritus, were recorded at four, eight, 12, and 24 hr after surgery. All patients were examined and interviewed at the outpatient clinic at two weeks, one, three, and six months postoperatively to assess for block-related neurological complications, such as motor weakness, numbness, or tingling sensation in the operative arm.

The primary outcome variable of this study was duration of analgesia. Based on the pilot data, we expected the

duration of analgesia to be 500 min, standard deviation (SD) 188 min after administration of 0.5% bupivacaine 20 mL (1:200,000 epinephrine). To show that the addition of magnesium 200 mg could prolong the duration of analgesia by 30%, we calculated that 26 patients per group were required to detect a statistically significant difference between groups at $\alpha = 0.05$ and 80% power.

Statistical analysis was performed using SPSS® version 12.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were analyzed using the independent samples Student's *t*-test for normally distributed data, and the Mann-Whitney U test was used to analyze nonparametric data. Data are presented as mean standard deviation (SD) or median interquartile range [IQR]. Discrete variables, such as physical status and adverse effects, were analyzed using the Chi square test or Fisher's exact test. For multiple comparisons, we used Bonferroni's correction. Statistical significance was defined as a *P* value ≤ 0.05 .

Results

Sixty-six patients undergoing arthroscopic rotator cuff repair were enrolled in the study. Three patients (two in the Magnesium Group, one in the Saline Group) were excluded from the study because of unsuccessful blockade. Five patients (three in the Magnesium Group, two in the Saline Group) were excluded because of incomplete follow-up evaluation. Fifty-eight patients (28 in the Magnesium Group, 30 in the Saline Group) were included in the data analysis for our primary outcome. Groups were similar with respect to age, sex, physical status, height, weight, duration of surgery, extubation time, and duration of stay in the PACU (Table 1).

There were no significant differences in the onset times for sensory and motor blocks. The duration of analgesia was prolonged by nearly two hours in the Magnesium Group (664 min) compared with the Saline Group (553 min) ($P = 0.017$) (Table 2). There were no significant differences in the durations of sensory or motor blocks (Table 2).

At 12 hr after surgery, patients in the Magnesium Group had less pain (median pain NRS 20; IQR [0-50]) than patients in the Saline Group (median NRS 50; IQR [20-70]) ($P = 0.012$). There were no significant differences between groups at four, eight, and 24 hr (Fig. 1).

Postoperative analgesic consumption (cumulative fentanyl dose of PCA, rescue intravenous analgesics, i.e., meperidine) was similar between groups at each measurement time (Fig. 2; Table 3). During surgery, there were no significant differences in mean blood pressure and heart rate between groups. Mean (SD) of fractional expired sevoflurane concentration during the intraoperative period

Table 1 Demographic and perioperative data

	Saline Group (<i>n</i> = 30)	Magnesium Group (<i>n</i> = 28)
Age (yr)	56 (8)	60 (8)
Sex (M/F)	17/13	18/10
ASA I/II	15/15	11/17
Height (cm)	163 (8)	162 (10)
Weight (kg)	71 (19)	67 (11)
Duration of surgery (min)	98 (45)	90 (22)
Intraoperative ephedrine	7	9
Extubation time (min)	17.1 (5.7)	14.7 (8.6)
Duration of PACU stay (min)	100 (23)	94 (22)

Values are mean (standard deviation) or number of patients. Saline Group = bupivacaine with normal saline; Magnesium Group = bupivacaine with magnesium sulphate; ASA = American Society Anesthesiologists' physical status; PACU = postanesthetic care unit

Table 2 Onset times, duration of sensory and motor blocks, and analgesia

	Saline Group (<i>n</i> = 30)	Magnesium Group (<i>n</i> = 28)	<i>P</i> value
Onset time of motor block	15.7 (2.6)	16.1 (5.4)	0.854
Onset time of sensory block	13.2 (2.6)	14.5 (3.4)	0.678
Duration of motor block	296 (132)	302 (145)	0.876
Duration of sensory block	518 (174)	636 (239)	0.081
Duration of analgesia	553 (155)	664 (188)	0.017*

Values are mean (standard deviation). Saline Group = bupivacaine with normal saline; Magnesium Group = bupivacaine with magnesium sulphate. * $P < 0.05$ between groups

was similar in both groups: 1.9 (0.4) and 1.9 (0.3) in the Magnesium and Saline Groups, respectively. No patient needed remifentanyl during the operation, and there was no difference between groups in the number of patients needing ephedrine (Table 1).

Incidences of nausea and vomiting and sedation scores were similar between groups in the first 24 hr postoperatively (Table 3). The toxicity attributable to magnesium sulphate, or block-related complications, such as motor weakness, numbness, or tingling sensation in the operative arm, were not observed at two weeks, one, three, and six months postoperatively.

Discussion

We showed that the addition of 10% magnesium sulphate 200 mg to a long-acting local anesthetic with epinephrine mixture prolonged the duration of analgesia and reduced postoperative pain after interscalene nerve block in patients undergoing rotator cuff repair.

Fig. 1 Intensity of postoperative pain as measured using numeric rating scale (NRS; from 0 = no pain to 100 = worst pain ever experienced) vs time after end of surgery. * $P < 0.05$ between groups. Values are presented as median (horizontal bar with diamond mark) with 25th to 75th percentiles (box) and 10th to 90th percentiles (whiskers). Saline Group = bupivacaine with normal saline; Magnesium Group = bupivacaine with magnesium sulphate

Fig. 2 Postoperative fentanyl consumption vs time after surgery. Values are presented as median (horizontal bar with diamond mark) with 25th to 75th percentiles (box) and 10th to 90th percentiles (whiskers). Saline Group = bupivacaine with normal saline; Magnesium Group = bupivacaine with magnesium sulphate

Although the mechanism of analgesia produced by magnesium is not fully understood, many authors have reported that magnesium is associated with a reduced analgesic requirement and less discomfort in the postoperative period via different routes of administration.⁷ Most of these studies have investigated systemic⁹ or neuraxial,^{7,8} administration of magnesium, whereas studies on the administration of magnesium for peripheral nerve block are scarce.¹⁰ The present randomized controlled study was performed to evaluate the effect of adding magnesium sulphate to long-acting local anesthetics (i.e., bupivacaine-epinephrine mixture) for interscalene nerve block.

The primary hypothesis for the analgesic properties of magnesium on peripheral nerves is the surface charge theory. Akutagawa *et al.*¹¹ showed that modulation of the external magnesium concentration bathing a nerve bundle resulted in enhancement of the nerve blockade due to local anesthetics. Mert *et al.*¹² reported that a high concentration of divalent ions (Mg^{2+} and Ca^{2+}) attracted by the negative charges of the outer membrane surface affected Na^+ channel gating and could cause hyperpolarization. If the nerve fibre is hyperpolarized, it is more difficult to achieve the threshold level, and it then results in nerve conduction block. Another possible mechanism for the analgesic action of magnesium is the voltage-dependent antagonism of NMDA receptors, leading to the prevention of central sensitization from peripheral nociceptive stimulation and a decrease in acute pain after tissue injury. In several investigations⁷⁻⁹ showing effective analgesia due to magnesium sulphate, magnesium was administered via the intravenous or neuraxial route so access to NMDA receptors was probable. However, involvement of NMDA receptors in peripheral blocks is less certain. Lee *et al.*⁴ reported no enhancement of the duration of interscalene nerve block when ketamine, the NMDA antagonist, was added to ropivacaine.

Table 3 Incidence of postoperative adverse effects and administration of rescue analgesics

	Saline Group (n = 30)				Magnesium Group (n = 28)			
	4 hr	8 hr	12 hr	24 hr	4 hr	8 hr	12 hr	24 hr
Nausea	1 (3)	3 (10)	4 (13)	10 (33)	3 (11)	6 (21)	10 (36)	12 (40)
Vomiting	0 (0)	1 (3)	1 (3)	5 (17)	1 (4)	2 (7)	0 (0)	4 (14)
Pruritus	0 (0)	1 (3)	1 (3)	2 (7)	0 (0)	0 (0)	0 (0)	3 (11)
Rescue analgesics	0 (0)	1 (10)	6 (20)	16 (53)	0 (0)	1 (4)	10 (36)	14 (50)
Sedation score (0/1/2/3)	25/4/0/1 (84/13/0/3)	29/1/0/0 (97/3/0/0)	25/4/1/0 (84/13/3/0)	25/2/1/2 (83/7/3/7)	26/2/0/0 (93/7/0/0)	25/2/1/0 (89/7/4/0)	25/2/1/0 (89/7/4/0)	26/2/0/0 (93/7/0/0)

Data are presented as number of patients with corresponding percentages in parentheses. Saline Group = bupivacaine with normal saline; Magnesium Group = bupivacaine with magnesium sulphate. Sedation score: 0 (awake), 1 (aroused by verbal commands), 2 (aroused by shaking), 3 (difficult to arouse). There were no statistically significant differences between the Magnesium and Saline Groups for any of these variables

The analgesic benefit observed in our study is consistent with that reported by Gunduz *et al.*¹⁰ who investigated the effect of perineural or systemic magnesium on the duration of axillary plexus block. They documented a significantly prolonged duration of sensory and motor blocks in the group receiving magnesium added to prilocaine, a local anesthetic of intermediate duration. However, they did not evaluate the effect of magnesium sulphate on the intensity of postoperative pain, the duration of analgesia, and the consumption of postoperative analgesics. In the present study, we used bupivacaine, a long-acting local anesthetic, with epinephrine (1:200,000) for interscalene nerve block. We showed a small but significant increase in duration of analgesia in the Magnesium Group (664 min) compared with the Saline Group (553 min), thus indicating that magnesium sulphate 200 mg prolongs the analgesic duration of a long-acting local anesthetic given for an interscalene nerve block. For 24 hr postoperatively, we recorded postoperative pain using the NRS as well as the consumption of fentanyl PCA and supplemental analgesics. Postoperative pain NRS and cumulative fentanyl consumption were lower in the Magnesium Group than in the saline group at all time periods (Figs. 1, 2), but there were no significant differences between the two groups except in pain NRS at 12 hr postoperatively ($P = 0.012$). The clinical relevance of these findings might be limited, however, because magnesium was associated with only a small prolongation of analgesia, and there was no difference between groups in cumulative fentanyl consumption.

This modest effect might be explained by a suboptimal magnesium dose. More significant changes could possibly be achieved with a dose higher than 200 mg, if toxicity can be avoided. The dose of magnesium used in this study was based on the data from Gunduz *et al.*¹⁰ who showed that the addition of magnesium sulphate 150 mg provided a pronounced prolongation of the duration of sensory and motor blocks compared with adding magnesium 100 mg, without systemic or neurotoxicity. They investigated patients undergoing forearm and hand surgery associated with mild to moderate postoperative pain, whereas we evaluated patients who underwent rotator cuff repair, which induces severe postoperative pain that can be difficult to manage without large doses of opioids. Therefore, because of the expected difference in the intensity of pain, we chose a cautious dose 200 mg ($2\text{--}4\text{ mg}\cdot\text{kg}^{-1}$), which is greater than the doses used in Gunduz *et al.*'s study. Several studies have found magnesium to be safe in intrathecal and epidural blockades. Chanimov *et al.*¹³ showed that intrathecal injection of 6.3% magnesium sulphate 0.02 mL ($4.6\text{ mg}\cdot\text{kg}^{-1}$) did not cause neurotoxicity, while 12.6% magnesium sulphate 0.02 mL ($9.2\text{ mg}\cdot\text{kg}^{-1}$) caused moderate vacuolation and severe histopathological demyelination. Another report¹⁴ described that the inadvertent

epidural injection of larger doses (8.7 g, 9.6 g) of magnesium sulphate did not cause neurologic toxicity in pregnant woman. However, we did not find a report associated with evidence of dose-responsiveness related to magnesium administered perineurally; this is another area that may warrant further investigation. The safety of perineural adjuvants has recently been the subject of debate that centres on the potential for neurotoxicity of the adjuvant drug itself or any co-administered preservatives.

The present study showed prolongation of analgesic duration without a decrease in consumption of postoperative opioids. This moderate effect can be explained by the type and concentration of local anesthetics, upon which the analgesic effect largely depended. Whereas the effectiveness in the analgesic duration may be similar for perineural adjuvants regardless of type of local anesthetic, the relative increase in the duration of analgesia is far more pronounced with intermediate-acting local anesthetics than with long-acting local anesthetics.² Although magnesium is likely to prolong the analgesic duration without reference to any local anesthetics, the clinical relevance of adding magnesium to a long-acting local anesthetic may be questioned because the relative gain will be minimal. Furthermore, mixed epinephrine to bupivacaine could have masked any pharmacodynamic effect of perineural magnesium, similar to the report in which clonidine failed to prolong the analgesic duration of ropivacaine and bupivacaine with epinephrine.¹⁵

In conclusion, the addition of magnesium sulphate to a bupivacaine-epinephrine mixture for interscalene nerve block prolonged the duration of analgesia and decreased postoperative pain after rotator cuff repair. From a clinical standpoint, the results might be modest because adding magnesium to bupivacaine did not reduce the postoperative opioid consumption. Nevertheless, this study suggests that magnesium may be a useful alternative as an adjuvant to long-acting local anesthetics for interscalene nerve block. Further studies are needed to elucidate the mechanism of action, to determine the optimal dose by conducting the investigation in a variety of ways (e.g., increase magnesium doses, use alternative pain control modalities with continuous infusion or various combinations of local anesthetics) and to examine the safety profile of magnesium before its routine use as a perineural adjuvant can be advocated.

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