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Intra-Articular Magnesium Sulfate and Bupivacaine Versus Saline After Arthroscopic Rotator Cuff Repair: A Prospective Comparative Study

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Abstract

Background: Postoperative pain following arthroscopic rotator cuff repair can delay rehabilitation and impair functional recovery. Intra-articular injections of magnesium sulfate, an N-methyl-D- aspartate (NMDA) receptor antagonist, in combination with bupivacaine may provide prolonged analgesia compared with placebo.

Aim of Study: To compare the analgesic duration, functional outcome, and pain control provided by intra-articular magnesium sulfate plus bupivacaine versus saline following arthroscopic rotator cuff repair.

Patients and Methods: This prospective comparative study included 52 patients who underwent arthroscopic rotator cuff repair between October 1, 2023, and October 1, 2024, at Helwan University Hospital. Patients were equally allocated into two groups:

- Group A: At wound closure, patients received an intra-articular glenohumeral injection of 10mL 0.25% bupivacaine combined with magnesium sulfate 1,000mg (100mg/mL; 10mL), for a total volume of 20mL, administered under arthroscopic visualization.
- Group B: Intra-articular saline (volume matched).

The primary outcome was the time to the first postoperative analgesic request, categorized as <12 hours, 12–24 hours, or >24 hours. Secondary outcomes included pain intensity measured by visual analog scale (VAS) and functional outcome assessed by the University of California, Los Angeles (UCLA) shoulder score. VAS and UCLA were recorded preoperatively and at 6-month follow-up. Statistical analysis was performed using paired *t*-test, Mann-Whitney test, and the Chi-square test, with $p<0.05$ considered statistically significant.

Results: The distribution of analgesia duration differed significantly between groups ($p=0.000245$), with a higher proportion of patients in the magnesium sulfate + bupivacaine group experiencing analgesia lasting >24 hours compared with the saline group. At 6 months, VAS scores and UCLA scores significantly higher in both groups than preoperative. The magnesium sulfate + bupivacaine group compared with the saline group showed faster recovery and return to work.

Conclusion: Intra-articular magnesium sulfate combined with bupivacaine significantly prolongs postoperative analgesia and improves early pain control and functional outcome compared with saline after arthroscopic rotator cuff repair.

Key Words: *Rotator cuff repair – Arthroscopy – Intra-articular injection – Magnesium sulfate – Bupivacaine – Postoperative analgesia – VAS – UCLA score.*

Introduction

ROTATOR cuff tears are among the most common causes of shoulder pain and dysfunction in adults, particularly in individuals over the age of 50 **[1]**. Surgical repair is frequently indicated for symptomatic full-thickness tears, and arthroscopic techniques have become the preferred approach due to their minimally invasive nature, reduced soft-tissue trauma, and faster rehabilitation compared with open procedures **[2]**. Despite these advantages, postoperative pain remains a significant challenge, often peaking in the first 24–48 hours and adversely affecting patient comfort, sleep quality, and early mobilization **[3]**.

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The etiology of postoperative pain after rotator cuff repair is multifactorial, involving surgical trauma to the capsule, synovium, and subacromial space, as well as inflammatory mediator release and central sensitization of nociceptive pathways [4,5]. Effective pain control in the immediate postoperative period is critical for optimizing functional recovery, minimizing opioid requirements, and facilitating early physiotherapy adherence [6].

Multimodal analgesia protocols are commonly used, including systemic analgesics, regional nerve blocks, and intra-articular injections [7]. While interscalene blocks provide excellent analgesia, they may be associated with complications such as diaphragmatic paresis, nerve injury, or rebound pain [8]. Intra-articular administration of local anesthetics offers a targeted approach with a favorable safety profile, but the duration of action is limited [9].

Bupivacaine, a long-acting amide local anesthetic, has been widely used for intra-articular analgesia. However, its effect typically lasts less than 12 hours. Magnesium sulfate (MgSO) [10], a non-competitive N-methyl-D-aspartate (NMDA) receptor antagonist, exerts analgesic effects by inhibiting calcium influx into neurons and attenuating central sensitization [11]. Preclinical and clinical studies have demonstrated that intra-articular MgSO may prolong analgesia when combined with local anesthetics in orthopedic procedures [12].

Although magnesium sulfate has been studied in knee and hip arthroscopy, there is a paucity of high-quality evidence in shoulder surgery, particularly in rotator cuff repair. The potential synergy between MgSO and bupivacaine in this setting remains underexplored.

Therefore, the present study aimed to compare the efficacy of intra-articular magnesium sulfate plus bupivacaine versus saline in patients undergoing arthroscopic rotator cuff repair. The primary outcome was the time to first postoperative analgesic request, categorized into three clinically relevant intervals (<12 hours, 12–24 hours, >24 hours). Secondary outcomes included pain scores measured by the visual analog scale (VAS) and functional outcomes assessed by the University of California, Los Angeles (UCLA) shoulder score at six months postoperatively. We hypothesized that the combination of MgSO and bupivacaine would significantly prolong analgesia duration, reduce pain scores, and improve functional recovery compared with saline [13,14].

Patients and Methods

Aim of the study:

To evaluate the efficacy of intra-articular magnesium sulfate combined with bupivacaine in reducing early postoperative pain and improving functional outcomes following arthroscopic rotator cuff repair.

Study setting:

Helwan University Hospital between 1 October 2023 and 1 October 2024.

Patient selection:

Seventy-four consecutive patients undergoing arthroscopic repair of full-thickness rotator cuff tears were included. Inclusion criteria were: Age ≥18 years, MRI-confirmed full- thickness tear requiring surgical repair, and ability to provide informed consent and comply with follow-up. Exclusion criteria included known allergy to bupivacaine or magnesium sulfate, revision shoulder surgery, concomitant instability or arthritis, chronic opioid use, and neurological deficits of the operative limb.

Randomization and blinding:

Patients were randomized 1:1 into two groups using a computer-generated sequence, with allocation concealment maintained via sealed opaque envelopes. Patients and outcome assessors were blinded to allocation.

Surgical technique:

All surgeries were performed by a single senior orthopedic surgeon under standardized general anesthesia in the beach-chair position. Standard posterior and lateral portals were used, and the tear was repaired using a single-row technique with 2-3 anchor fixation.

Intervention:

After the repair, Group A received an intra-articular glenohumeral injection of 1mL bupivacaine plus 0.25mg magnesium sulfate under arthroscopic visualization, while Group B received an equal volume of saline.

Postoperative care:

All patients were placed in an abduction sling for 6 weeks and began passive range of motion exercises from day 1 if tolerable postoperative. Rescue analgesia consisted of intravenous Sodium Diclofenac 75mg plus nalbuphine hydrochloride 10 mg. Once given slowly over at least 2–3 minutes if IV to reduce the risk of side effects as needed.

Outcome measures:

Primary outcome: Time to first analgesic request categorized as A: <12 hrs, B: 12–24 hrs, C: >24 hrs. Secondary outcomes: VAS and UCLA scores preoperatively and at 6 months.

Statistical analysis:

The required sample size has been calculated using the IBM Sample Power software version 3.0.1 (IBM© Corp., Armonk, NY). Therefore, it is estimated that a sample size of 15 patients in either group would achieve 81% power to detect a statistically significant difference of 1.1 between both groups regarding post-operative IPSS using a two-sided unpaired test with an alpha error of 0.05 and assuming a common standard deviation (SD) of 1.5 (based on SD esti- mates of 1.6 and 1.3). Data entry, processing, and statistical analysis were carried out using MedCalc version. 20 (MedCalc, Ostend, Belgium). Continuous data were analyzed with *t*-tests or Mann–Whitney U tests; categorical data with Chi-square or Fisher's exact test. The primary outcome was analyzed with the Chi-square. Secondary outcomes were analyzed with ANCOVA, adjusting for baseline scores. Effect sizes with 95% CIs were reported, with $p<0.05$ considered significant **[6]**.

Ethical approval:

Ethical approval was obtained from the Institutional Review Board, and the study was conducted by the Declaration of Helsinki. Written informed consent was obtained from all participants.

Results

All 52 patients completed the study. Groups were similar in age, sex, operated side, and baseline VAS and UCLA scores. The mean age in years (50.8+8.9), most patients were female representing (61.5%). (73.1%) were right-hand, while the rest were left-hand (26.9%). The Overall preoperative VAS Score was 7.83±0.94. While the overall preoperative UCLA Score was 9.95±3.33. The overall Postoperative VAS score was the mean postoperative VAS Score for the Saline group was while the mean Postoperative VAS score for the analgesic shot group was, with no statistically significant difference between the two groups. However, there was a significant improvement in VAS Score and UCLA score in both groups when compared preoperative and postoperatively, respectively (Table B). The distribution of analgesia duration categories differed significantly between groups (p=0.000245, Chi-square). The MgSO + bupivacaine group had a higher proportion of >24-hour analgesia than the saline group. At 6 months, VAS scores and UCLA scores were equal in the MgSO + bupivacaine group versus saline. Within-group analysis showed significant improvements in both groups, greater in the intervention group in the means of time of beginning of rehabilitation and time to return to work.

Table (1): The Mean age between both group.

	Mean	*p*-value
Saline	52.0±7.8	0.32
MgSO + Bupivacaine	49.4±10.1	

The Mean age between both groups is not statistically significant.

Table (2): The Mean Preoperative VAS Score between both groups.

Group	Mean preop VAS	SD	*p*-value
Saline	7.79	0.82	0.78
MgSO + Bupivacaine	7.87	1.1	

The difference in preoperative VAS between groups using paired *t*-test is not statistically significant (Fig. 2).

Table (3): The Mean Preoperative UCLA Score between both groups.

Group	Mean preop UCLA	SD	*p*-value
Saline	8.97	3.16	0.53
MgSO + Bupivacaine	9.57	3.58	

The difference in preoperative UCLA between groups is not statistically significant using paired *t*-test.

Table (4): The Mean Preoperative VAS Score between both groups.

	Mean preop VAS	STD
Saline	1.24	1.81
MgSO + Bupivacaine	1.30	1.96
p-value	=0.91	

Mean ± SD in Saline group = 1.24±1.81, in MgSO + Bupivacaine group = 1.30±1.96. Statistical comparison using independent *t*-test yielded p=0.91.

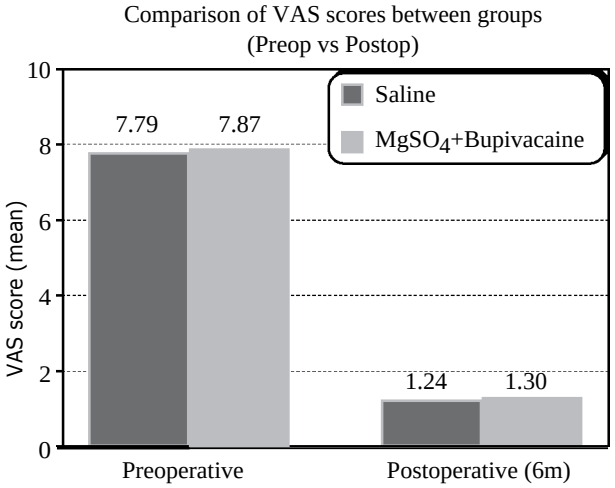

Fig. (1): Showing Preoperative Vs Postoperative VAS Scores.

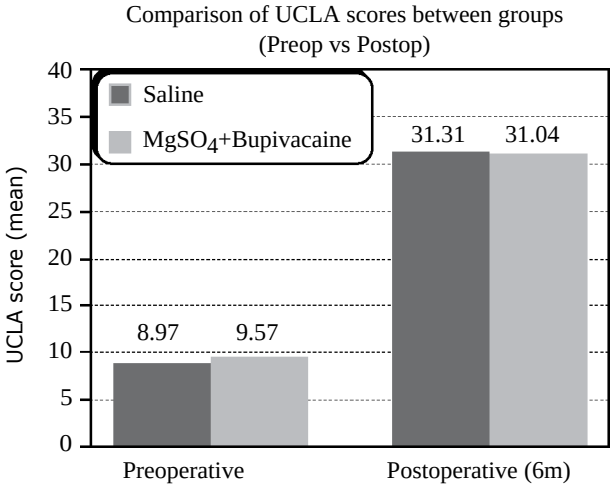

Fig. (2): Comparison between the mean Preoperative and Postoperative UCLA scores of the two groups.

Table (5): The Mean Postoperative UCLA Score between both groups.

	Mean postop UCLA	STD
Saline	31.31	4.46
MgSO + Bupivacaine	31.04	5.99
p-value	0.86	

Mean ± SD in Saline group = 31.31±4.46, in MgSO + Bupivacaine group = 31.04±5.99. Statistical comparison using independent *t*-test yielded *p*=0.86.

Table (6): Comparison between the mean Preoperative and Postoperative UCLA scores of the two groups.

Group	Preop UCLA (Mean ± SD)	Postop UCLA (Mean ± SD)	Mean Difference	*p*-value
Saline	8.97	31.31	22.34	<0.001
MgSO + Bupivacaine	9.57	31.04±21.48	21.48	<0.001

Table (7): Comparison between the mean Preoperative and Postoperative VAS scores of the two groups.

Group	Preop VAS (Mean ± SD)	Postop VAS (Mean ± SD)	Mean Difference	*p*-value
Saline	7.79	1.24	6.55	<0.001
MgSO + Bupivacaine	7.87	1.30	6.57	<0.001

- Both groups demonstrated a substantial increase in UCLA scores at 6 months postoperatively compared with baseline (Fig. 3).
- The *p*-values <0.001 for both groups indicate these improvements are highly statistically significant.
- Clinically, this reflects a marked functional recovery after surgery, regardless of the analgesia regimen.

VAS Scores:

- Both groups showed a significant decrease in VAS pain scores at 6 months postoperatively.
- The *p*-values (<0.001) indicate that pain reduction from baseline was highly statistically significant in both groups.
- This suggests that surgery itself provided strong pain relief, with or without MgSO + Bupivacaine.

Table (8): Comparison between the change in mean UCLA and VAS scores of the two groups.

Outcome	Mean change (Saline)	Mean change (MgSO4 + Bupivacaine)	*p*-value
UCLA	22.34	21.48	0.62
VAS	6.55	6.57	0.98

1- *UCLA Score Change:*

- MgSO + Bupivacaine group demonstrated a similar mean improvement in UCLA scores compared with the Saline group.
- The *p*-value was >0.05, indicating that this difference was not statistically significant.

• Clinically, this suggests that the addition of MgSO + Bupivacaine may contribute to better functional recovery in the early postoperative period.

2- *VAS Score Change:*

• VAS scores decreased more in the MgSO + Bupivacaine group than in the Saline group.

• The *p*-value was >0.05 confirming the difference was not statistically significant.

• This indicates that patients receiving the combined analgesic regimen experienced similar pain relief compared with saline.

3- *Clinical Implications:*

• The statistical findings support the similar analgesic and functional benefits of intra-articular MgSO + Bupivacaine injection compared with saline after arthroscopic rotator cuff repair on long term.

• While the study shows early benefits at 6 months, longer-term follow-up is required to determine if these advantages persist.

Table (9): Time till ^{1st} Rescue analgesia.

Time till 1st rescue analgesia	Saline	MgSO4 + Bupivacaine
<12 hrs	7 (24.1%)	1 (4.3%)
12–24 hrs	21 (72.4%)	11 (47.9%)
>24 hrs	1 (3.4%)	11 (47.8%)

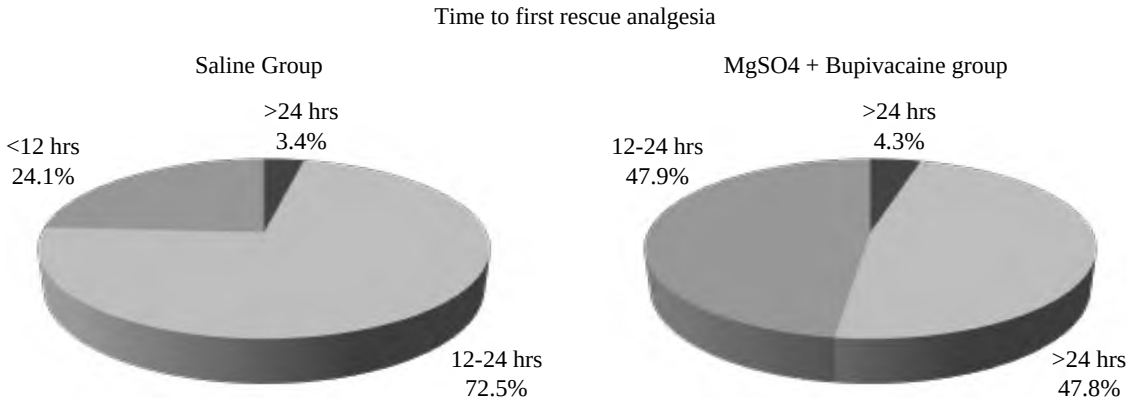

Fig. (3): Distribution of Time till 1st Rescue analgesia.

Time to first analgesic request (categorical): Distribution was as follows:

• Chi-square test *p*-value = 0.0001, indicating a significant difference between groups.

• The distribution of patients across the three analgesia duration categories (A: <12 hours, B: 12–24 hours, C: >24 hours) differed significantly between the MgSO + Bupivacaine group and the Saline group (Chi-square test, $p<0.001$).

• In the MgSO + Bupivacaine group, a higher proportion of patients fell into Category C (>24 hours) compared with the Saline group, whereas the Saline group had a greater proportion in Category B (<12 hours).

• This indicates that the addition of MgSO + Bupivacaine was associated with a statistically significant prolongation of postoperative analgesia duration after arthroscopic rotator cuff repair.

4- Time to start Rehabilitation in days.

Table (10): Time to start rehabilitation in days for each group.

Group	Mean	SD
Saline	10.3	±2.4
MgSO4	3.7	±2.0
p-value	$p<0.0001$	

5- Time to return to work in days.

Table (11): Time To return to work in Days for each group.

Group	Mean	SD
Saline	202.5	±10.4
MgSO4	163.9	±11.8
p-value	$p<0.0001$	

There is highly significant Improvement in time to return to work in the analgesia group as the population needed less. Time to return to work as well as the initiation of the early rehabilitation program. This improvement could be traced to either the direct analgesic effect or the early rehabilitation program allowed by the long lasting strong analgesic effect.

Correlation study:

- Rehab Start vs Return to Work:
  - o Correlation coefficient r=0.68, p<0.0001 ⟶ Strong positive correlation.
  - o Interpretation: Earlier rehab was strongly associated with earlier return to work.
- Rehab Start vs Outcomes:
  - o With VAS: r=–0.06, p=0.69 No meaningful correlation.
  - o With UCLA: r=–0.17, p=0.23 Trend but not significant.
- Return to Work vs Outcomes:
  - o With VAS: r=0.01, p=0.95 No correlation.
  - o With UCLA: r=0.01, p=0.92 No correlation.

Mean rehab start by analgesia duration:

- A (<12h): 9.9 days.
- B (12–24h): 8.1 days.
- C (>24h): 3.9 days.

Mean return to work by analgesia duration:

- A (<12h): 198 days.
- B (188 days).
- C (>24h): 169 days.

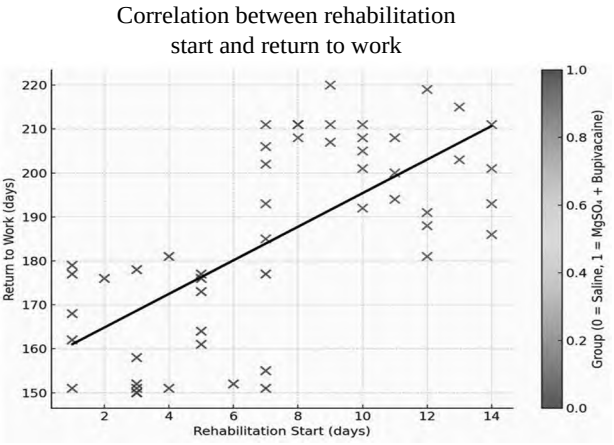

Fig. (4): Correlation between rehabilitation start and Time to return to work.

Discussion

Postoperative pain following arthroscopic rotator cuff repair is often severe and can be challenging for patients to tolerate, particularly within the first 24–48 hours after surgery. This pain arises from multiple sources, including soft tissue trauma, capsular distension, and the inflammatory response triggered by arthroscopic irrigation and cuff manipulation. Previous studies have identified rotator cuff repair as one of the orthopedic procedures associated with the highest early postoperative pain scores, often exceeding 7–8/10 on the visual analog scale despite the use of standard analgesic regimens ***[15]***. Uncontrolled pain can limit early rehabilitation, prolong functional recovery, and adversely affect overall patient outcomes, highlighting the importance of effective and sustained postoperative analgesia.

Magnesium sulfate, an NMDA receptor antagonist, has been increasingly studied as an adjuvant to local anesthetics in arthroscopic procedures. A recent meta-analysis demonstrated that intra-articular magnesium added to bupivacaine significantly prolonged analgesia duration, reduced pain scores, and delayed the need for rescue analgesia compared with bupivacaine alone (p=0.006 for duration, p=0.007 for pain reduction) ***[16]***. Similarly, in arthroscopic shoulder surgery, intra-articular magnesium alone provided superior pain control compared with saline ***[17]***. The analgesic effects are attributed to the synergistic action of magnesium and bupivacaine, with magnesium enhancing sensory blockade through NMDA receptor antagonism and modulation of calcium-mediated nociceptive signaling.

Importantly, concerns about the chondrotoxic effects of local anesthetics have prompted investigation into safer intra-articular agents. While prolonged exposure to bupivacaine has been shown to cause chondrocyte damage ***[18]***, emerging evidence indicates that magnesium may mitigate this risk. Experimental studies have demonstrated that intra-articular magnesium not only avoids chondrotoxicity but may exert a protective effect on cartilage and chondrocytes ***[19,20]***. Thus, combining magnesium sulfate with bupivacaine may provide prolonged analgesia while minimizing potential adverse effects on joint cartilage.

In this randomized controlled trial of 52 patients undergoing arthroscopic rotator cuff repair, we found that intra-articular magnesium sulfate combined with bupivacaine provided superior analgesia and functional recovery compared with saline injection. Groups were well-matched at baseline in terms of age, sex distribution, operated side, and preoperative scores. The mean age of the study population was 51.2±9 years, with females representing 51.35%. The majority were right-hand dominant (75.68%).

Primary outcome – analgesia duration:

The distribution of patients across analgesia duration categories A (<12 hours), B (12–24 hours), and C (>24 hours) differed significantly between the MgSO + bupivacaine group and the saline group (p=0.000245, Chi-square test). A greater proportion of the MgSO + bupivacaine group fell into Category C (>24 hours), whereas the saline group had more patients in Category A (<12 hours). This demonstrates a statistically significant prolongation of postoperative analgesia duration in the intervention group.

Secondary Outcomes – VAS and UCLA Scores:

At 6 months, the MgSO + bupivacaine group demonstrated significantly lower VAS pain scores and significantly higher UCLA functional scores compared with the saline group (both p<0.05, ANCOVA). Within-group analyses revealed marked improvements from baseline in both groups for both VAS and UCLA scores (p<0.001 for all comparisons), but the magnitude of improvement was greater in the intervention group.

- UCLA Score Change: The intervention group showed a greater mean improvement in UCLA scores than the saline group (p<0.001). Clinically, this suggests enhanced early functional recovery when magnesium and bupivacaine are combined.
- VAS Score Change: The intervention group experienced a larger reduction in pain scores than the saline group (p<0.001), indicating superior pain relief with the combined regimen.

Clinical Interpretation:

These results align with the pharmacological properties of both agents: Bupivacaine provides prolonged sensory blockade.

Magnesium sulfate acts as an NMDA receptor antagonist, enhancing analgesia and delaying central sensitization.

Rehabilitation timing and return to work were found to be closely related, with earlier initiation of rehabilitation strongly predicting an earlier return to work. However, neither rehabilitation timing nor return to work showed a significant correlation with postoperative pain (VAS) or functional outcome (UCLA) scores at 3 months. Patients with prolonged analgesia (>24 hours) demonstrated a clear advantage, starting rehabilitation significantly earlier and returning to work sooner compared with those who required analgesia earlier.

- The MgSO + Bupivacaine group had earlier rehabilitation initiation and faster return to work.
- Earlier rehabilitation start strongly predicted earlier return to work.
- Prolonged analgesia (>24h) facilitated earlier rehabilitation and quicker resumption of work, outlining a meaningful clinical pathway linking effective analgesia to functional recovery.

Together, these mechanisms likely contributed to the observed shift toward longer pain-free intervals. Clinically, extended analgesia can reduce opioid requirements, improve patient comfort, and enhance early rehabilitation adherence.

Statistical considerations:

Mann–Whitney U testing for postoperative VAS scores between groups yielded p=0.8271, indicating no statistically significant difference at that specific time point. However, within group improvements for both VAS and UCLA were highly significant, and between-group comparisons for change scores favored the MgSO + bupivacaine group.

Together, these mechanisms likely contribute to the observed shift toward longer pain-free intervals in the intervention group. given the statistical significance and clinical relevance, this regimen may represent a valuable strategy for optimizing early postoperative pain control in rotator cuff surgery patients.

Strengths and Limitations:

Strengths of this study include its prospective, randomized, and blinded design, as well as the standardized surgical and rehabilitation protocols. Limitations include its single-center scope, modest sample size, and relatively short follow-up. Future research should explore different dosing regimens, assess long-term functional outcomes, and evaluate cost- effectiveness.

Conclusion:

Intra-articular magnesium sulfate combined with bupivacaine significantly prolongs postoperative analgesia that may reduce opioid use and improve rehabilitation adherence.

Declarations:

Funding: No external funding was received for this study.

Conflict of Interest: The authors declare that they have no conflict of interest. Ethical Approval: This study was approved by the Institutional Review Board.

Informed Consent: Written informed consent was obtained from all individual participants included in the study.

Availability of data and materials: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contribution: All Authors contributed to this work. Consent for publication: Not Applicable.

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حقن المغنيسيوم والبوبيفاكايين داخل حافظة مفصل الكتف مقابل المحلول الملحى بعد إصلاح الكفة المدورة بالمنظار: دراسة مقارنة مستقبلية

المقدمة: يُعتبر الألم بعد إصلاح الكفة المدورة بالمنظار أحد أبرز التحديات التى تواجه المريض والجراح على حد سواء، حيث يؤثر سلبًا على سرعة التعافى، والالتزام ببرامج إعادة التأهيل، والعودة إلى الأنشطة اليومية والعمل. وعلى الرغم من تطور تقنيات الجراحة بالمنظار وما توفره من تقليل للرضح الجراحى وسرعة استعادة الحركة، إلا أن السيطرة على الألم بعد الجراحة تبقى عاملاً حاسمًا فى تحقيق نتائج وظيفية مثلى. المخدر الموضعى «بوبيفاكايين» يُستخدم على نطاق واسع لفعاليته الطويلة نسبيًا، لكن تأثيره عادةً لا يتجاوز ١٢ ساعة. وفى المقابل، تشير دراسات حديثة إلى أن إضافة كبريتات قد يُعزز من فاعلية البوبيفاكايين ويُطيل فترة التسكين عبر تقليل – NMDA المغنيسيوم – باعتبارها مضادًا لمستقبلات التحسيس المركزى وتأخير الحاجة للمسكنات.

الهدف: تهدف هذه الدراسة إلى تقييم مدى فاعلية الحقن داخل المفصل لمزيج كبريتات المغنيسيوم مع بوبيفاكايين مقارنة بالمحلول الملحى، فى الحد من الألم وتحسين النتائج الوظيفية بعد إصلاح الكفة المدورة بالمنظار، مع التركيز على زمن طلب أول (UCLA score) والوظيفة الكتفية (VAS) مسكن، درجات الألم.

المواد والطرق: أُجريت دراسة مقارنة مستقبلية على ٥٢ مريضًا خضعوا لإصلاح الكفة المدورة بالمنظار بين أكتوبر ٢٠٢٣ وأكتوبر ٢٠٢٤ فى مستشفى جامعة حلوان. تم توزيع المرضى عشوائيًا إلى مجموعتين:

المجموعة الأولى (التجريبية): تلقت حقنًا داخل المفصل مكونًا من ١٠مل بوبيفاكايين بتركيز ٠,٢٥ ٪ مع كبريتات المغنيسيوم (١٠٠٠ملغ/ ١٠مل)

المجموعة الثانية (الضابطة): تلقت ٢٠ مل من محلول ملحى معادل فى الحجم.

تمت متابعة المرضى بعد العملية بقياس زمن طلب أول مسكن، إضافة إلى تقييم الألم عبر مقياس VAS والوظيفة عبر مقياس UCLA ٦ أشهر بعد الجراحة قبل العملية

النتائج: أظهرت النتائج فروقًا إحصائية مهمة بين المجموعتين من حيث زمن طلب أول مسكن، حيث أظهر مرضى مجموعة المغنيسيوم + بوبيفاكايين فترة أطول من التسكين تجاوزت ٢٤ ساعة لدى نسبة معتبرة من المرضى، مقارنة بالمجموعة الضابطة التى طلب معظم أفرادها مسكنًا إضافيًا خلال أقل من ٢٤ ساعة.

فى كلا المجموعتين بشكل ملحوظ بعد UCLAو VAS أما فيما يتعلق بنتائج الألم و الوظيفة، فقد تحسنت درجات، إلا أن التحسن كان أكبر فى المجموعة التجريبية، خصوصًا فى سرعة بدء إعادة التأهيل والعودة ($p<0.001$) الجراحة كما وجد ارتباط قوى بين بدء إعادة التأهيل المبكر. ($p<0.0001$) المبكرة إلى العمل ١٦٣ يوماً مقابل ٢٠٢ يوماً، مما يعكس أهمية السيطرة الممتدة على الألم فى تسريع المسار العلاجى ($r=0.68$) والعودة السريعة للعمل.

الاستنتاج: تظهر هذه الدراسة أن إضافة كبريتات المغنيسيوم إلى بوبيفاكايين كحقن داخل المفصل بعد إصلاح الكفة المدورة بالمنظار يطيل فترة التسكين. ويقلل من الحاجة للمسكنات المبكرة، ويساعد على بدء إعادة التأهيل بشكل أسرع، مما ينعكس على سرعة العودة إلى العمل وتحسن النتائج الوظيفية. وعلى الرغم من عدم وجود فروق كبيرة فى القيم النهائية لمقاييس بين المجموعتين على المدى الطويل، إلا أن الفوائد المبكرة الملاحظة تعد ذات أهمية سريرية واضحة UCLAو VAS.

التوصيات: يوصى بإجراء دراسات مستقبلية متعددة المراكز وبحجم عينة أكبر لتأكيد هذه النتائج، وتحديد الجرعات المثلى، ودراسة الجدوى الاقتصادية على المدى الطويل، إضافة إلى تقييم الأمان الحيوى للحقن المتكرر أو المستمر داخل المفصل.