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Comparative Study between Magnesium Sulfate and Dexamedetomidine Added to Lidocaine in Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Surgery

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ABSTRACT

Background: The anaesthetic sector makes substantial use of local anaesthetic drugs, although anaesthetists have challenges due to the diverse local anaesthetics' short acting times. Numerous perineural adjuvants have been explored to speed up the onset and prolong the analgesic effects of nerve blocks. The role of central sensitizations and N-methyl-D-aspartate (NMDA) receptors in post-operative pains has been highlighted by the acquaintance with pain mechanisms.

Objective: The current study aimed to compare the effect of magnesium sulfate (100 mg in 1mL volume) and Dexmedetomidine (100 mcg in 1mL volume) added to lidocaine (20 ml 2%) on the onset time and duration of supraclavicular brachial plexuses block in patients undergoing upper limb surgery.

Patients and methods: This prospective randomized-controlled study included 60 patients that were subjected to surgical procedure in upper limb as part of the standard anesthetic techniques.

Results: There was statistically significant increase of the duration of motor and sensory block among group D than in group M. Duration of motor block for group M was 277.17 ± 54.34 min versus 482.50 ± 72.75 min for group D. Time to first analgesia for group M was 5.10 ± 1.56 h versus 8.70 ± 3.38 h for group D. A statistically high significant increase total dose of analgesia consumed was detected for group M as compared to group D (8.80 ± 2.44 mg for group D versus 12.53 ± 4.03 mg for group M).

Conclusion: Addition of magnesium sulfate or dexmedetomidine to lidocaine in supraclavicular brachial plexus block prolong the duration of sensory and motor block. Both magnesium sulfate and Dexmedetomidine groups showed improved postoperative analgesia with less analgesic requirements.

Keywords: Magnesium Sulfate, Dexamedetomidine, Lidocaine, Supraclavicular brachial plexus block, Upper limb surgery.

INTRODUCTION

For upper limb surgical anaesthetic and postoperative pain management, brachial plexus blocks (BPB) are frequently employed. There have been several methods employed, and each one has pros and cons. The supraclavicular nerve block is the simplest and most effective since it blocks the majority of the brachial plexus branches, which leads to a quick start and high success rates for upper limb surgery and analgesia [(1)]. In recent years, ultrasound (US) has developed into a crucial technique for nerve blocks. Identification of vascular structures and other aberrations in the needle's route is a key advantage of using US guidance in nerve blocks. This allows for the avoidance of these structures and thereby lowers the risk of complications [(2)].

A local anaesthetic with a very broad range of applications, lidocaine has a medium solubility in both water and lipids. With a lower pKa, it may be employed in all regional block types. The majority of doctors favour long-acting anaesthetics for peripheral nerve blocks, despite the fact that it is one of the drugs that may also be utilised in these blocks. The requirement for a sustained anaesthetic effect in the postoperative phase is the cause of this [(3)].

A variety of medications that are used with local anaesthetics to speed up the start of action, extend the duration of action, and improve the likelihood of a successful blockage. Magnesium is known to have pain-relieving properties and helps to regulate the quantity of calcium in cells. For instance, magnesium sulphate ($MgSO_4$) can assist lower the quantity of anaesthetics used during surgery and the amount of opioids required afterwards. Magnesium hasn't been extensively researched for its effects as an adjuvant to anaesthetics during brachial plexus blocks (BPB) despite its well-known advantages for pain management [(4)].

Dexmedetomidine has analgesic, sedative, and antihypertensive effects and is a highly selective, specific, and powerful 2-adrenergic agonist. For surgical patients undergoing peripheral nerve blockade and regional anaesthesia treatments, mixing dexmedetomidine with local anaesthetics may also be effective [(5)].

The present study was designed to compare the effect of magnesium sulfate (100 mg in 1ml volume) and dexmedetomidine (100 mcg in 1mL volume) added to lidocaine 2% (20 ml) on the onset time and duration of supraclavicular brachial plexus block in patients undergoing upper limb surgery.

PATIENTS AND METHODS

This prospective randomized controlled study included 60 patients who were subjected to surgical procedure in upper limb as part of the standard anesthetic techniques.

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Inclusion criteria: ASA physical status I and II patients aged between 18-60 years of both gender and scheduled for unilateral upper limb surgeries below level of the shoulder under supraclavicular brachial plexus block were enrolled in a comparative randomized prospective clinical study.

Exclusion criteria: Patients who refused to be included in addition to those with peripheral neuropathy of the upper limb, diabetic patients, infection at the injection site and altered mental status or history of allergy to local anaesthetics. Patients with coagulopathy or planned for receiving general anaesthesia at the same operation for any cause (bone graft, skin graft, etc.) and main site of the surgery is the medial side of the arm at axilla level (T2 distribution).

Patients were randomly allocated into two equal groups (30 patients in each group):

Magnesium sulfate (M) group (30 patients): Patients received 20 ml of lidocaine 2% + 100 mg in 1ml volume of magnesium sulfate. Dexamedetomidine (D) group (30 patients): Patients received 20 ml lidocaine 2 % + 100 mcg in 1ml volume dexamedetomidine.

Equipment and material used: Ultrasound machine (sonosite, M turbo) linear probe.

Preoperative assessment

All patients were checked before surgery to fulfill the history as regards any drug intake or any medical problem then the patient options for anesthesia were discussed. General examination, systemic examinations and airway assessment were done. Preoperative fasting of minimum 6 h was ensured before operation. Risks and benefits were properly explained to the patient.

Assessment parameters:

1- **The Hemodynamic parameters:** Heart rate (HR), mean arterial blood pressure (MAP) and oxygen saturation were monitored preoperative (base line), and every 10 min from start till the end of surgery and 2, 6, 12 h postoperative.

2- **Evaluation of onset and duration of sensory block:** The sensory block was evaluated every 5 minutes after the end of injection till 20 minutes and then every 30 min after the end of surgery till the first 12 hours and thereafter, hourly until the block had completely worn off. The sensory block was assessed by the pinprick sensation with a blunt 25-G needle in all dermatomes innervated by the brachial plexus (C5-T1) in the distribution of median, radial, ulnar and musculocutaneous nerves.

3- **Evaluation of onset and duration of motor block:** Onset time of motor block was defined as the time interval between the end of local anaesthetic administration and complete motor block, while the duration of the motor block was defined as the time interval from complete motor block (Grade 2) to complete recovery of motor function of hand and forearm (grade 0).

Duration of analgesia (DOA): the time between the complete sensory block and the first analgesic request by the patient.

First request of analgesia: Pain was assessed using the Visual Analogue Scale (VAS score) at first hour postoperative then 2, 6, 12 and 24 hour after operation.

Visual Analog Scale (VAS): After operation, point Visual Analogue Scale (VAS) for pain that ranged (from 0 = no pain to 10 = the worst imaginable pain). The VAS was assessed and recorded at first hour post-operative, then 2 nd, 6th, 12th, and 24th hours after the operation, by an anesthesiologist, who was not aware of the group of study drugs.

4- **Laboratory Investigation:** Serum glucose was assessed preoperative, after injection, 30 min after injection and 1 hr postoperative.

Sample Collection: Two ml of venous blood were collected aseptically from the patient in this study and dispensed in a sterile serum separator tube (SST) and were allowed to clot for 30 minutes in room temperature before centrifugation for 15 minutes at 1000 x g and plasma were stored at - 20 °C. The blood glucose level was assessed by Hexokinase/G6PDH method on Cobas Integra 400 plus autoanalyzer.

Ethical consent:

An approval of the study was obtained from Al-Azhar University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Data were fed to the computer and analyzed using IBM SPSS Corp. (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) and mean standard deviation (mean ± SD) for parametric data after testing normality using Kolmogorov-Smirnov test. Significance of the obtained results was judged at 0.05 level. Patients and surgical data were subjected to Student's t-test to compare normally distributed quantitative data. Chi-Square was used for comparison of the qualitative data. Parametric tests: Student t-test was used to compare 2 independent groups. Non Parametric tests: Mann-Whitney U test was used to compare 2 independent groups. Pearson's correlation: The Pearson product-moment correlation was used to determine the strength and direction of a linear relationship between two

normally distributed continuous variables. P value ≤ 0.05 was considered significant.

RESULTS

Demographic data showed that there was no statistically significant difference between groups regarding their age, sex, weight, height, body mass index and ASA classification (Table 1).

Table (1): Demographic data of the studied groups

	Group M (N=30)	Group D N=30	Test of significance
Age/years Mean ± SD	34.63 ± 10.66	33.98 ± 9.48	t=0.249 p=0.804
Sex Male Female	14 (46.7%) 16 (53.3%)	12 (40%) 18 (60%)	t =0.272 p=0.602
ASA N(%) I II	26 (86.7%) 4 (13.3%)	24 (80.0%) 6 (20.0%)	t =0.480 p=0.488
Weight/kg Mean ± SD	80.80 ± 7.72	81.90 ± 3.53	t=0.709 p=0.481
Height/cm Mean ± SD	164.35 ± 6.43	163.23 ± 7.06	t=0.586 p=0.125
BMI (kg/m^2) Mean ± SD	29.89 ± 1.88	30.59 ± 1.23	t=0.658 p=0.122

p>0.05 non-significant

There was non-statistically significant difference between studied groups as regards heart rate pre-, intra- and until 12 hr post-operative. There was no significant difference between studied groups regarding mean MAP pre-, intra- and post-operative till 12 hr. There was non-significant difference between studied groups as regards O_2 saturation assessed pre-, intra- and postoperative till 12 hr (Table 2).

Table (2): Comparison of heart rate, mean arterial blood pressure and O_2 saturation between studied groups pre-, intra- and post-operative

Heart rate/minute	Group M (N=30) (mean ± SD)	Group D (N=30) (mean ± SD)	Test of significance
Pre-operative	82.27±10.65	85.43±9.31	t=1.23 p=0.225
After injection	82.60±11.75	87.73±8.45	t=1.94 p=0.057
10 minutes	75.77±8.76	77.27±7.54	t=0.711 p=0.480
20 minutes	72.63±9.35	73.90±6.84	t=0.114 p=0.910
40 minutes	75.07±7.98	77.80±6.85	t=1.42 p=0.160
60 minutes	76.0±6.58	77.57±8.59	t=0.793 p=0.431
Post-operative	73.90±10.08	72.20±6.68	t=0.769 p=0.445
2h post-operative	77.37±10.21	79.50±7.92	t=0.904 p=0.370
6h post-operative	74.80±8.20	75.0±7.31	t=0.100 p=0.921
12 h post-operative	72.63±9.35	73.67±5.99	t=0.509 p=0.612
MAP(mm/Hg)			
Pre-operative	77.47±14.49	76.07±13.45	t=0.388 p=0.700
After injection	80.63±10.59	79.67±9.90	t=0.365 p=0.716
10 minutes	72.37±8.97	71.47±8.45	t=0.400 p=0.691
20 minutes	79.30±9.89	78.03±8.66	t=0.528 p=0.600
40 minutes	81.33±11.52	80.27±10.65	t=0.372 p=0.711
60 minutes	75.80±8.56	74.70±7.34	t=0.534 p=0.595
Post-operative	78.87±14.95	77.47±13.96	t=0.375 p=0.709
2h post-operative	80.87±11.49	80.50±12.31	t=0.119 p=0.906
6h post-operative	80.20±12.61	78.80±11.47	t=0.450 p=0.655
12 h post-operative	81.87±15.74	80.33±14.66	t=0.390 p=0.698
O_2 saturation%			
Pre Operative	99.0±0.0	99.23±0.43	t=2.97 p=0.004*
After injection	99.37±0.56	99.50±0.508	t=0.969 p=0.336
10 minutes	99.93±0.25	99.97±0.18	t=0.584 p=0.561
20 minutes	99.93±0.25	100.0±0.0	t=1.44 p=0.155
40 minutes	99.37±0.56	99.40±0.498	t=0.245 p=0.808
60 minutes	99.50±0.508	99.27±0.45	t=1.88 p=0.065
Post-operative	99.27±0.45	99.27±0.44	t=0.0 p=1.0
2h post-operative	99.63±0.556	99.77±0.43	t=1.04 p=0.303
6h post-operative	99.87±0.34	99.93±0.25	t=0.851 p=0.398
12 h post-operative	99.70±0.47	99.70±0.47	t=0.0 p=1.0

p>0.05 non-significant

There was statistically significant delay of onset of motor block and sensory block in group M than in group D, the onset of motor block for group M was 18.62 ± 1.77 min versus 15.70 ± 1.69 min for group D and onset of sensory block for group M was 16.03 ±

2.64 min versus 12.38 ± 1.98 min for group D (Table 3).

Table (3): Comparison onset of motor & sensory block between studied groups

	Group M (N=30) (mean ± SD)	Group D (N=30) (mean ± SD)	Test of significance
Onset of motor block/ minute	18.62±1.77	15.70±1.69	t=6.51 p<0.001*
Onset of sensory block/ minute	16.03±2.64	12.38±1.98	t=6.06 p<0.001*

P –t ≥ 0.05 significant

There was statistically significant increase in duration of motor and sensory block among group D than in group where M duration of motor block was 277.17 ± 54.34 min versus 482.50 ± 72.75 min for group D. Time to first analgesia for group M was 5.10 ± 1.56 h versus 8.70 ± 3.38 h for group D. A statistically high significant increase in total dose of analgesia consumed was detected for group M as compared to group D (8.80 ± 2.44 mg for group D versus 12.53 ± 4.03 mg for group M) (Table 4).

Table (4): Comparison of duration of motor & sensory block between studied groups pre- and post-operative

	Group M (N=30) (mean ± SD)	Group D (N=30) (mean ± SD)	Test of significance
Duration of motor block/minutes	277.17± 54.34	482.50±72.75	t=12.38 p<0.001*
Duration of sensory block /minute	477.2±122.12	547.33±100.01	t=2.56 p=0.013*
Time to first analgesic /hour	5.10± 1.56	8.70±3.38	t=5.29 p<0.001*
Total analgesic consumption (mg)	12.53± 4.03	8.80±2.44	t=4.34 p<0.001*

P ≤0.05 significant, p<0.01 high significant.

There was no statistically significant difference between studied groups as regards random blood sugar (RBS) at all measure times. **Pre-operative:** showed 100.17 ± 10.87 mg/dl in group M and 101.17 ± 13.43 mg/dl in group D. **Intra-operative:** After injection RBS was 109.50 ± 14.93 mg/dl in group M while in group D it was 105.50 ± 13.54 mg/dl. 30 minutes after injection: showed 107.50 ± 12.09 mg /dl in group M, while it was 109.50 ± 12.82 mg/dl in group D. **1 hr Postoperative:** It was 110 ± 12.52 mg/dl in group M, while it was 110.83 ± 14.15 mg/dl in group D (Table 5).

Table (5): Comparison of mean random blood sugar between studied groups pre-, intra- and post-operative

RBS (mg/dl)	Group M (N=30) (mean ± SD)	Group D (N=30) (mean ± SD)	Test of significance
Pre-operative	100.17±10.87	101.17±13.43	t=0.317 p=0.752
After Injection	109.50±14.93	105.50±13.54	t=1.09 p=0.282
30 minutes after Injection	107.50±12.09	109.50±12.82	t=0.622 p=0.537
1hr Post-operative	110±12.52	110.83±14.15	t=0.242 p=0.810

p>0.05 non-significant

There was no statistically significant difference between studied groups as regards adverse effects in group M & D. Nausea occurred in 3 patients in group M and in 2 patients in group D. Vomiting occurred in 1 patient in group M and group D. Hypotension and bradycardia occurred in 2 patients in group M and group D (Table 6).

Table (6): Comparison of adverse effects between studied groups as reported by patients

Adverse effects	Group M (N=30) (mean ± SD)	Group D (N=30) (mean ± SD)	Test of significance
Nausea	3(10.0%)	2(6.6%)	P=0.994
Vomiting	1(3.3%)	1(3.3%)	
Hypotension	2(6.6%)	2(6.6%)	
Bradycardia	2(6.6%)	2(6.6%)	

p>0.05 non-significant.

DISCUSSION

As regards hemodynamic measurements (HR, MAP and SPO_2), in the present study, we found that there was statistically insignificant difference between studied groups parameter pre-, intra- and until 12 hr postoperative. Similar results are reported by **Hassan and Abdelkareem [6]** where they compared the effect of adding dexamedetomidine or magnesium sulfate to local anaethetic drug in fifty patients and found that there was no significant difference between group M and group D in hemodynamic parameter. In addition, the results are in accordance with study done by

Akhondzadeh *et al.* [7] who added DEX or magnesium sulfate to lidocaine in supraclavicular block in 40 cases which did not cause significant differences between the studied groups as regards hemodynamic parameter.

Concerning onset of motor & sensory block, the current study demonstrated that there was significant delay in onset of motor and sensory block among group M than in group D. This is in accordance with **Hassan and Abdelkareem** [6] who reported that onset time of sensory and motor block was shorter in group D than in group M. Also, **Singh *et al.*** [8] investigated the effects of addition of $MgSO_4$, or DEX to ropivacaine in 60 patients for supraclavicular nerve block. They found that the onset of sensory and motor block was shortened in group D than in group M. Besides, **Das *et al.*** [1] concluded that the use of dexamedetomidine or magnesium sulfate as an adjuvant to ropivacaine 0.5% for supraclavicular BPB in 90 case prolonged the onset of sensory and motor block in group M more than in group D.

As regard duration of sensory and motor block, our current finding showed significant increase in duration of motor and sensory block among group D than in group M**.** These results are compatible with **Hassan and Abdelkareem** [6] who showed that there was significant difference between group M and group D. Both Mg sulphate and dexamedetomidine increased the duration of block and analgesia, but dexamedetomidine increased the duration more than Mg sulphate. In accordance with our research **Akhondzadeh *et al.*** [7] reported that the addition of Mg sulphate or DEX to lidocaine increased the length of sensory and motor blocks in the supraclavicular brachial plexus block in upper limb surgery under ultrasound guidance in group D more than in group M. Moreover, **Rao *et al.*** [9] concluded that the addition of magnesium sulfate or DEX to 0.5% bupivacaine in supraclavicular brachial plexus block for upper limb surgeries in 90 patients (divide into 3 group M, D and C) increased the duration of sensory and motor blocks in group D more than in group M or C.

In terms of time to first analgesic request we found that there was prolonged time of analgesia in group D more than in group M and there was significant increase of total dose of analgesic consumed for group M as compared to group D. In same line, **Hassan and Abdelkareem** [6] have demonstrated that there was prolonged time of analgesia for group D more than in group M. Additionally, the study showed that group D required less amount of analgesia and a smaller number of patients required injections as rescue analgesic than patients in group M in first 24 h of postoperative period. Similarly **Elyazed and Mogahed** [10] have demonstrated that the total dose of analgesia with dexamedetomidine group was less than in Mg Sulphate group. Dexamedetomidine group provided delay of first time of request analgesia than mg sulfate group M. Also, **Swami *et al.*** [11] noted that there was delay in first dose of analgesia in group D than in group M and decrease of total dose of analgesia in group D than in group M.

As regards random blood sugar, in the current study we found that there was no statistically significant difference between studied groups pre-, intra- and 1hr post-operative. In same line, **Hassan and Abdelkareem** [6] have demonstrated that **no** significant different in random blood sugar between study group pre-, Intra- and1 hr post-operative. **Singh *et al.*** [8] reported that addition of dex or Mg sulfate to local anesthesia for elective forearm and hand surgeries under SBPB in 60 cases showed no significant different in random blood sugar between study group pre-, intra- and 1 hr post-operative. On the same line, **Bi and his colleague** [12] found that there was no significant difference in random blood sugar between study groups pre-, intra- and1hr post-operative.

In the present study we found that there was no statistically significant difference between studied groups as regards adverse effect between group M and group D. Likewise**, Hassan and Abdelkareem** [6] stated that there was no significant difference between the three studied groups (dex vs $MgSO_4$ vs controls) regarding rate of complications (nausea, hypotension and bradycardia). In the same line, **AbdAlsalam and Mohamed** [13] have reported that addition of dex or mg sulfate to local anesthesia in 60 patients for SBPB, there were no records of any side effects of local anesthetics and adjuvant happened throughout the first day postoperatively in two group**.** In contrast, **Hashim *et al.*** [14] illustrated that adding of dex to local anesthesia showed significant bradycardia without change when adding magnesium sulfate to local anesthesia.

CONCLUSION

Addition of magnesium sulfate or dexamedetomidine to lidocaine in supraclavicular brachial plexus block prolonged the duration of sensory and motor block. Both magnesium sulfate and Dexmedetomidine groups showed improved postoperative analgesia with less analgesic requirements. However, lower postoperative pain scores, coupled with longer time to first rescue analgesic requirements was observed in dexamedetomidine group as compared to magnesium sulfate group. No difference between magnesium sulphate and dexamedetomidine as regards postoperative complications. Glucose levels were not different between magnesium sulphate and dexamedetomidine groups.

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Author contribution: Authors contributed equally in the study.

REFERENCES

1. **Das A, Majumdar S, Halder S *et al.* (2017):** Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: A prospective, double-blinded and randomized controlled study. Saudi Journal of Anaesthesia, 8 (1): 72-76.
2. **Santavana H (2014):** Physics and instrumentation of ultrasound. Crit Care Med., 35: 314-322.
3. **Özmen Ö, Alici H, Çelik M *et al.* (2013):** The effect of addition of lidocaine to bupivacaine on anesthesia beginning time, block time, and block quality in lateral sagittal infraclavicular block. Turkish Journal of Medical Sciences, 43 (4): 542-547.
4. **Mahgoub A (2015):** The addition of magnesium sulfate or dexamethasone to levobupivacaine for ultrasound –guided supraclavicular brachial plexus block for upper lime surgery: A double blinded comparative study. Research and Opinion in Anaesthesia & Intensive Care, 2: 116-120.
5. **Kandil Y (2018):** Sensory and motor effects of dexmedetomidine as an adjuvant to bupivacaine for brachial plexus block. Al-Azhar Assiut Medical Journal, 16 (4): 343-48.
6. **Hassan A, Abdelkareem A (2021):** Comparative Study between Magnesium Sulphate Versus Dexmedetomedine as Additives to Levobupivacine in Ultra Sonographic Guided Supraclavicular Block in Patient Undergoing Forearm Surgeries. The Egyptian Journal of Hospital Medicine, 83 (1): 1010-1016.
7. **Akhondzadeh R, Rashidi M, Gousheh M *et al.* (2018):** The effect of adding dexmedetomidine as an adjuvant to lidocaine in forearm fracture surgeries by supraclavicular block procedure under ultrasound-guided. Anesth Pain Med., 8 (4): e74355. doi: 10.5812/ aapm.74355.
8. **Singh S, Raman R, Singh G *et al.* (2019):** Randomised control trial of dexmedetomidine and magnesium sulfate as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Int J Contemp Med., 7: 39-44.
9. **Rao L, Jeyalakshmi V, Nagaraju M *et al.* (2015):** The effect of magnesium sulfate as an adjuvant to 0.5% bupivacaine on motor and sensory supraclavicular brachial plexus blockade. International Journal of Basic & Clinical Pharmacology, 4 (2): 317-321.
10. **Elyazed M, Mogahed M (2018):** Comparison of magnesium sulfate and dexmedetomidine as an adjuvant to 0.5% ropivacaine in infraclavicular brachial plexus block. Anesthesia, Essays and Researches, 12 (1): 109-13.
11. **Swami S, Keniya V, Ladi S *et al.* (2012):** Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian Journal of Anaesthesia, 56 (3): 243-47.
12. **Bi Y, Wu J, Zhang Y *et al.* (2020):** Effect of different doses of intrathecal dexmedetomidine as an adjuvant combined with hyperbaric ropivacaine in patients undergoing cesarean section. Frontiers in Pharmacology, 11: 342-47.
13. **AbdAlsalam M, Mohamed N (2022):** A comparative study between magnesium sulfate and dexmedetomidine as adjuvants to bupivacaine using ultrasound-guided lumbar-plexus block in lower abdominal surgeries. Al-Azhar Assiut Medical Journal, 20 (1): 72-84.
14. **Hashim R, Hassan R (2019):** The efficacy of adjuvants to bupivacaine in ultrasound-guided supraclavicular block: a comparative study between dexmedetomidine, ketamine, and fentanyl. Ain-Shams Journal of Anesthesiology, 11 (1): 1-8.