Original Research Paper

Volume - 13 | Issue - 05 | May - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

COMPARATIVE EVALUATION OF EPIDURAL MAGNESIUM SULFATE AND DEXAMETHASONE AS AN ADJUVANT TO BUPIVACAINE FOR POSTOPERATIVE ANALGESIA AFTER LOWER LIMB ORTHOPAEDIC SURGERY- A RANDOMISED PROSPECTIVE DOUBLE-BLIND STUDY.

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ABSTRACT **Background and Aims:** Epidural anesthesia is an effective technique, with the advantage of safety, efficiency and prolonged postoperative pain relief. MgSO4 and Dexamethasone are additives used for prolonging duration of analgesia when used with local anaesthetics. This randomized, prospective, double blind study was carried out to compare duration of postoperative pain relief & demand of analgesic after epidural MgSO4 50 mg and dexamethasone 8 mg with 0.125% bupivacaine in lower limb orthopaedic surgery under combined spinal epidural anaesthesia. **Materials and Methodology:** This prospective, randomised, double blind clinical study includes 70 patients of either sex with age between 18-65 years posted for elective lower limb orthopaedic surgery under combined spinal epidural anaesthesia (CSE). In Group D Epidural dexamethasone 8 mg + 0.125% bupivacaine 8 ml and in Group M Epidural MgSO4 50 mg diluted to 2ml with normal saline + 0.125% isobaric bupivacaine 8 ml was given at the conclusion of surgery. Duration of post operative analgesia, Verbal rating pain score (VRPS), analgesic requirement in 24 hours, Ramsay sedation score, haemodynamic stability and side effects were assessed. **Results:** Duration of post operative analgesia is more with MgSO4 (245.95 ± 39.96) than dexamethasone (170.48 ± 29.28). MgSO4 has less Verbal rating pain score as compared with dexamethasone group. Tramadol requirement for 24 hrs after MgSO4 (331.42 ± 27.35)mg is significantly lower than dexamethasone (355.71 ± 23.55)mg. Ramsay sedation score for MgSO4 is significantly lower than Dexamethasone at 2hrs and 4hr.There was no significant difference in haemodynamic parameters in both groups. **Conclusion:** Post operative analgesia with epidural MgSO4 50mg is more effective than dexamethasone 8mg when given with 0.125% bupivacaine. Both additives provide stable hemodynamic response.

KEYWORDS : Epidural analgesia, Dexamethasone, MgSO4.

INTRODUCTION:

Alleviation of postoperative pain is an important objective for the Anesthesiologists. Inadequate postoperative pain relief delay recovery, increase healthcare costs, and reduce patient satisfaction. Inadequate pain control result in increased morbidity or mortality. Epidural anaesthesia is safe and effective technique for abdominal and lower limb surgeries of long duration, with added advantage of extending the pain relief in the postoperative period. Magnesium combined with bupivacaine produces reduction in postoperative pain when given intraarticularly in comparison to either bupivacaine or magnesium alone, or to saline placebo. Some studies revealed that epidural bupivacaine-dexamethasone admixture had almost the same analgesic potency as bupivacaine-fentanyl with opioid sparing and antiemetic effects avoiding opioid side effects. ' Apart from being an epidural adjunct, epidural dexamethasone may improve postoperative outcome in terms of fatigue, pain, and early return of recreational activity.

MATERIAL AND METHOD:

This prospective, randomised, double blind study was conducted in tertiary care hospital. 70 consecutive patients posted for elective lower limb orthopaedic surgery under combined spinal epidural anaesthesia (CSE) of either sex between age 18-65 years, ASA grade I and II were selected. Those patients are excluded who refused for procedure, history of allergy to study drugs or local anaesthetics, patient with contraindication to CSE, pregnant Female and psychiatric disease.

SELECTION OF PARTICIPANTS:

Patients were randomly allocated using computer generated randomization list & sealed envelope technique into 2 groups with 35 patients in each group with allocation ratio 1:1. Preoperative evaluation was done one day prior to surgery and informed written consent was obtained.

STUDY PROCEDURE:

On the day of surgery essential monitors like NIBP,ECG, SP02 attached vital parameters were recorded. Combined Spinal Epidural anesthesia was given using two space technique. Epidural anaesthesia is given with 18 G touhy needle was used, correct placement of catheter was verified. Spinal anaesthesia was given with 0.5% bupivacaine 15-17.5mg in L3-L4 space 25G spinal anaesthesia needle. Oxygen was administered at 5 litres per minute using face mask. Intraoperative IV fluid infusion or blood transfusion were given according to intraoperative blood loss. Intravenous Midazolam 1 mg/kg was given for intraoperative sedation.

After two segment regression of the spinal anaesthesia patients in G**roup D** received Epidural dexamethasone 8 mg mixed with 0.125% bupivacaine 8 ml (Total volume 10 ml) and in **Group M** Epidural MgSO4 50 mg diluted to 2ml with normal saline mixed with 0.125% isobaric bupivacaine 8 ml (Total volume 10 ml) at the conclusion of surgery.

Vital parameters were monitored by pulse rate and MAP every 5 min till first 30 min and every 15 min till 2 hours in post anaesthesia care unit.

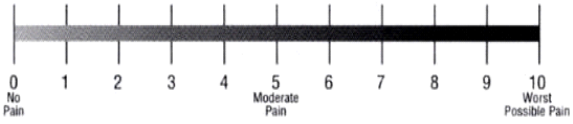

Figure 1: Verbal rating pain score

No pain = 0
Mild pain = 1-2
Moderate pain = 3-4
Severe pain =5-6
Very severe pain = 7-8
Worst possible pain = 9-10
VRPS and Ramsey Sedation score is observed at 0Hr, 2Hr, 4Hr, 6Hr, 12Hr, 24Hr

Sedation score	Clinical response
0.	Paralyzed, unable to evaluate
1.	Awake
2.	Lightly sedated
3.	Moderately sedated, follows simple commands
4.	Deeply sedated, responds to non painful stimuli
5.	Deeply sedated, responds to painful stimuli
6	Deeply sedated, unresponsive to painful stimuli

Figure 2:Ramsey Sedation Score

Rescue analgesia was provided if VRPS >2 with inj. Tramadol 50mg in 100 ml NS IV and if persistent VRPS >2 Inj. Diclofenac 75mg IM.

Sample size and statistical analysis:

Data was collected and analysis was done with statistical software SPSS Ver. 2.0 (Statistical package for the social sciences). The results were expressed as mean ± standard deviation for continuous variables while frequency and percentage for discrete data. Continuous variables were analysed using unpaired two-tailed Student's 't' test. Discrete data was analysed using Chi square test.

The sample size formulae used are as follows:

$$n_1 = \frac{(\sigma_1^2 + \sigma_2^2 / \kappa)(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}$$

$$n_2 = \frac{(\kappa * \sigma_1^2 + \sigma_2^2)(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}$$

The notation for the formulae are:
n_1 = sample size of Group 1
n_2 = sample size of Group 2
σ_1 = standard deviation of Group 1
σ_2 = standard deviation of Group 2
Δ = difference in group means
κ = ratio = n_2/n_1
$Z_{1-\alpha/2}$ = two-sided Z value (eg. Z=1.96 for 95% confidence interval).
$Z_{1-\beta}$ = power

RESULTS AND OBSERVATION

The demographic characteristics were comparable in both groups.

Table : Demographic data comparison in both groups

Demographic Characteristics	Group D	Group M	P value
Age	34±10	31± 6.9	0.005162
Gender	Male = 30 (85.71%) Female = 5 (14.28 %)	Male = 26 (74.28 %) Female = 9 (25.71 %)	0.121867

Duration of Post-operative Analgesia

- Statistically significant difference between duration of post-operative analgesia in Group D and Group M was observed after administration of dexamethasone and magnesium sulfate.

Table 2: Duration of Post-operative analgesia

	Group D		Group M			
	Mean	SD	Mean	SD	p value	Significance
Duration of analgesia (min)	170.48	29.28	245.95	39.96	0.000000003	Significant

Post-operative verbal rating pain score:

There is Statistically significant difference between VRPS in Group D and Group M at 2 and 4 Hr postoperatively it shows there is higher VRPS for Group D than Group M ($p < 0.05$). where as no significant association at 0hr, 6hr,12hr and 24hr.

Table 3: Post-operative Verbal rating pain score

VRPS	Group D		Group M		P value	Significance
TIME	MEAN	SD	MEAN	SD		
0 Hr	0	0	0	0	0	Not Significant
2 Hr	0.54	0.50	0.06	0.23	0.000004	Significant
4 Hr	1.54	0.51	1.02	0.38	0.00001	Significant
6 Hr	1.94	0.24	1.94	0.23	1	Not Significant
12 Hr	1.91	0.28	2	0	0.083	Not Significant
24 Hr	1.89	0.32	2	0	0.043	Significant

Ramsey Sedation Score:

Ramsey sedation score was significantly higher in Group D than in Group M at 6 and 12 hr post-operatively ($p < 0.05$), and insignificant at other time intervals.

Table 4: Ramsey sedation score

SED SCO	Group D		Group M			Significant
TIME	MEAN	SD	MEAN	SD		
0 Hr	1.6	0.50	1.3	0.48	0.031354176	Significant
2 Hr	1.03	0.17	1	0	0.324374711	not significant
4 Hr	1.03	0.16	1	0	0.324374711	not significant
6 Hr	1	0	1.26	0.44	0.001597427	Significant
12 Hr	1.43	0.50	1.11	0.32	0.002858293	Significant
24 Hr	1.14	0.36	1.20	0.41	0.532829808	not significant

Tramadol requirement for 24 Hrs:

- There is statistically significant difference for tramadol requirement at 24-Hr Group D and Group MgSO4. ($p < 0.05$)
- Tramadol requrent was significantly higher for 24Hr Group D as compared to Group M .
- As there is increased requirement of tramadol in group D pt become sedated after reliving pain

Diclofenac requirement in 24 Hrs:

- There is no statistically significant difference for 24-Hr diclofenac requirement between Group D and Group M. ($p < 0.05$)

Table 5: Analgesic requirement in both groups

Analgesic Dose	GROUP D		GROUP M		P value	significance
	MEAN	SD	MEAN	SD		
Tramadol Dose	355.71	23.55	331.42	27.35	0.00017	Significant
Diclofenac Dose	10.23	26.34	3.57	16.36	0.30601	Not Significant

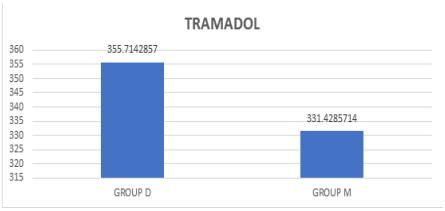

Figure 3:Tramadol Requirement in both groups

Figure 4: Diclofenac requirement in both groups

Incidence of PONV was 5.71% (2/35) in Group D. No patient experienced PONV in group M but the difference was not statistically significant. No incidence of Shivering, vomiting, itching, pruritis was observed in Both Groups.

Two patient in Group M had periumbilical pain.

There was no significant difference observed in haemodynamic parameters in both the group.

DISCUSSION :

The relief of postoperative pain is a crucial objective for Anesthesiologists, as it is an important component of providing quality care for surgical patients. There are reports of analgesic effects of dexamethasone during peripheral nerve block and epidural blocks in adult patients[8]. Epidurally injected dexamethasone added to local anaesthetics was found to prolong the duration of the epidural block and to have an opioid-sparing and antiemetic effect in the

postoperative period [5].

Shrestha et al. in 2007[9] compared addition of dexamethasone (8mg) or tramadol (2mg/kg) to epidural bupivacaine, and the duration of postoperative analgesia was substantially more in the dexamethasone group than tramadol (1028 and 453min). **Hefni et al**.[10] evaluated the efficiency and safety of different doses of epidural dexamethasone for postoperative analgesia. Patients received 10ml epidural plain bupivacaine 0.25% in the control group with 4mg, 6mg, and 8 mg dexamethasone in the other groups. After surgery, the time to first analgesic requirement was significantly prolonged in the dexamethasone groups compared with the control group. There was a significant reduction in postoperative meperidine consumption during the first 24 h in the dexamethasone groups in comparison with the control group. The visual analogue scale (VAS) scores were significantly lower and the patient satisfaction score was significantly higher in the dexamethasone groups compared with the control group.

Arcioni et al.[11] reported that combined intrathecal and epidural administration of magnesium sulfate reduced postoperative analgesic requirements. In this study author randomly assigned to receive intrathecal MgSO4 (94.5 mg, 6.3%), epidural MgSO4 (2%, 100 mg/h), intrathecal and epidural MgSO4 combined or spinal anesthesia alone (controls). Of the 120 patients enrolled, 103 (86%) completed the study. Morphine consumption at 36 h after surgery was 38% lower in patients receiving spinal anesthesia plus epidural MgSO4 (2%, 100 mg/h).

Whether the administrative route is intravenous, epidural, or intrathecal, the actual site of action of magnesium sulfate is at the spinal cord NMDA receptors. The analgesic effect primarily depends on Mg2+ blocks inward current flow through ion channels linked to NMDA receptors. In addition, magnesium sulfate has been compared with other epidural adjunct analgesic drugs like dexmedetomidine but risk of sedation increased . Radwan et al. compared magnesium sulfate with fentanyl and Mohammad et al. compared magnesium sulfate with clonidine[6] found the effect of magnesium sulfate on postoperative pain to be comparable to that of the other drugs.

Dexamethasone when used as additive also decreases the consumption of opioid as (Siji Thomas MD 2006) this study shows that preoperative epidural administration of dexamethasone with or without bupivacaine, reduces postoperative pain and morphine consumption following laparoscopic cholecystectomy.

Our study shows that there is significant reduction for opioid consumption in postoperative period for magnesium sulfate (331.42 ± 27.34) mg as compared with Dexamethasone group (355.71 ± 23.55) mg ($p < 0.05$).

Asokumar et al[15] and **Salman et al (2021)**[16] used epidural magnesium sulphate 50mg same as our study with bupivacaine 0.5%. **Ranjan, Ravi et al (2019)**[17]used bupivacaine 0.5% with Magnesium sulfate in dose of 50mg and similar to our study found out that Magnesium sulfate group showing reduction in consumption of opioids.

Farouk and Ibrahim(2007) found that there were significantly lower pain scores on rest or movement in the pre-magnesium group compared with the post-magnesium and control groups (P<0.05). The daily analgesic consumption in the pre-magnesium group was significantly less than the other two groups (P<0.05) and the dose consumed in the post-magnesium group was significantly smaller than the control group (P<0.05).

One observable finding was periumbilical pain in Group M 5.71% (2/35) which was also found by **Dror et al**. As shown by **M. R. Razavizadeh et al (2017)** in their studies Only five (22.7%) of the patients had nausea in the first hour after the procedure, and all were in the control group (P=0.048). None of the patients in the dexamethasone group had nausea. None of the patients in either group had vomiting.

The study by **A. A. Yousef et al 2017**[19] also shows There was no significant difference in the incidence of hypotension, nausea and vomiting and duration of motor blockade between the groups. Women who received magnesium showed less shivering and later onset of post operative pain(P<0.05). Study by **Farouk S, Ibrahim et al** [18] also shows, the groups were similar with respect to haemodynamic and respiratory variables, sedation, pruritus, nausea, and vomiting.

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