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Comparison Of Effect Of Magnesium Sulphate And Fentanyl On Haemodynamics And Neuroaxial Anaesthesia As An Adjuvant To Bupivacaine In Infraumbulical Surgeries Under Subarachnoid Block

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Abstract

Introduction:

In an effort to increase patient satisfaction and lengthen the duration of the block, intrathecal adjuvant use has grown in favour. Sufficient pain management is necessary to speed up functional recovery and promote rehabilitation, allowing patients to resume regular activities sooner. This research compares the effectiveness of 25 mcg of fentanyl and 100 mg of magnesium sulphate as an adjuvant to bupivacaine in subarachnoid block for invasive procedures. Comparing the two medication's effects on hemodynamic parameters, the time it takes for sensory and motor blockage to begin, and other secondary goals.

Materials and Methods:

A prospective comparative study that was carried out over a one and a half-year period (January 2020–June 2022) in the anesthesiology department of the District Hospital in Tumakuru on 82 patients who were scheduled for elective subarachnoid block surgeries and who met the study's inclusion requirements. Patients were divided into two groups at random: Group A received a local anaesthetic mixture containing 15 mg of heavy bupivacaine and 100 mg of magnesium (total volume 3.5 ml); Group B received a local anaesthetic mixture containing 15 mg of heavy bupivacaine and 25 milligrams of fentanyl (total volume 3.5 ml). The onset, duration, hemodynamic parameters, occurrence of side effects, and complications of these groups were compared.

Result:

When magnesium sulphate was added to bupivacaine, the onset of sensory blockage took longer than when bupivacaine was used alone. The greatest sensory block level reached was comparable in the two groups. There were differences between the two groups in the mean time to beginning of motor blockage with Bromage score 1 (inability to bend the hip). fentanyl group experienced a quicker start of motor blockage than the magnesium group. The highest motor block level obtained indicated that there was no discernible difference between the two groups. With a p value of 0.34, the analgesic duration was not significant. In group A (magnesium sulphate), it was 5.22±0.50 hours, whereas in group B (fentanyl)

Conclusion:

In contrast to the addition of fentanyl, the current study's findings indicate that the intrathecal start of sensory and motor blockade was delayed by the addition of 100 mg magnesium sulphate to 0.5% hyperbaric bupivacaine. Furthermore, when added at a dosage of 100 mg, magnesium sulphate prolongs the duration of analgesia to an equivalent degree as fentanyl, but with a stable hemodynamic profile and fewer adverse effects.

Introduction

On August 16, 1898, August Bier brought spinal anaesthesia to clinical practice for the first time. Since then, the most often used anaesthetic technique in clinical practice for invasive procedures has been spinal anesthesia[13]. The subarachnoid block remains the preferred option because to its quick start, excellent blockage, little infection risk, low failure rate, and cost-effectiveness; nevertheless, it has a shorter duration of postoperative analgesia8. In an effort to increase patient satisfaction and lengthen the duration of the block, intrathecal adjuvant usage has grown in favour in recent years. Sufficient pain control is crucial for promoting rehabilitation and expediting functional recovery, allowing patients to resume their regular activities sooner. There have been reports that adding adjuvant improves the quality of the spinal anaesthesia. The opioids include the most often used medications as adjuvants in spinal anaesthesia, include sufentanil, fentanyl, and morphine[1]. Intrathecal adjuvants include clonidine, a centrally acting alpha agonist, dexmedetomidine, neostigmine, ketamine, and midazolam, among many more medications. The induction of central sensitization by peripheral nociceptive stimulation can be inhibited by magnesium sulphate. Inadequate blood brain penetration to attain an appropriate concentration of magnesium in CSF fluid is one limitation of the parenteral route of magnesium for regulation of antinociception via NMDA channel antagonism[1,4.]

When given intrathecally, the highly lipid-soluble medication fentanyl diffuses into the spinal cord and quickly binds to opioid receptors in the dorsal horn. As a result, analgesia sets very quickly and spreads little across the brain. Opioids don't impede motor recovery, despite their numerous adverse effects, which include respiratory depression, nausea and vomiting, pruritus, urine retention, and hemodynamic instability[12]. This research compares the effectiveness of 25 mcg of fentanyl and 100 mg of magnesium sulphate as an adjuvant to bupivacaine in subarachnoid block for invasive procedures. This cross-sectional comparison study will be carried out among patients who have had unsuccessful infraumbilical operations in the Department of Anaesthesiology at District Hospital Tumkur between January 2021 and June 2022. the requirements for inclusion. Informed consent and counselling will be provided. In each case, baseline studies will be completed. Every patient will undergo a standard pre-anaesthetic examination. Based on a three-point qualitative scale, the beginning and length of the sensory and motor blockade following the subarachnoid block will be evaluated. The Verbal Numerical Rating Scale (VNRS) and Visual Analogue Scale (VAS) will be used to assess pain. A cold spirit swab will be

used to measure sensation, and the Modified Bromide score will be used to evaluate the motor block's quality. Parameters related to hemodynamics will be noted. If there are any issues, these will be reported. Every piece of data will undergo statistical analysis, comparison, and representation through the use of tables and charts.

This study, which meets the inclusion criteria, will be a cross-sectional comparative analysis of patients who have had non-traumatic spinal cord surgery at the Department of Anaesthesiology at the District Hospital Tumkur between January 2021 and June 2022. Informed consent must be obtained along with counselling. In every instance, baseline studies will be carried out. Every patient will have a routine pre-anaesthetic assessment. A three-point qualitative scale will be used to evaluate the onset and length of sensory and motor blockage following the subarachnoid block. Pain will be assessed using the Visual Analogue Scale (VAS) and Verbal Numerical Rating Scale (VNRS). The Modified Bromide score will be used to evaluate the quality of the motor block and use a cold spirit swab to measure sensation. Hemodynamic variables will be noted down. If there are any issues, these will be reported. Every piece of data will undergo statistical analysis, comparison, and representation through the use of tables and charts.

Materials And Methods

Study Design:-
Comparative cross sectional study.

Study Duration: -
One and half year (January 2021 to June2022)

Inclusion Criteria: -
1. Patients aged between 18to 60yrs of age posted for elective infraumblical surgeries
2. American society of Anesthesiologist grade I and II patients.

Exclusion Criteria:-
1. Patient refusal.
2. American society of anaesthesiologist grade III and IV patients.
3. Patients with hepatorenal land cardiovascular diseases, local in fection, bleeding disorders,
4. Patients who had received opioid or who had already received magnesium sulphate by other route

Statistical Methods: -
The Excel spreadsheet will get the data entry.
For quantitative data, mean and standard deviation (SD) will be used; for categorical variables, frequency and percentages will be used in the descriptive statistical analysis. The Chi-square test will be used to examine the relationship between the category variables. The analysis will be conducted using SPSS version-20 statistical software.

A comparative cross-sectional study was carried out on 82 patients with physical status grades I and II according to the American Society of Anaesthesiologists, who were scheduled for elective intracranial procedures under subarachnoid blocks at the anaesthesia department of District Hospital, Tumkur, following approval from the ethical committee. The envelop approach was used to divide them into two groups. There were 41 individuals in each group who were specifically The data, which comprised the anaesthetic information, intraoperative and

postoperative monitoring, observation for side effects and complications, and demographic (age, gender, co-morbidities) and morph ometry (weight) characteristics of participating patients, were collected using Performa.

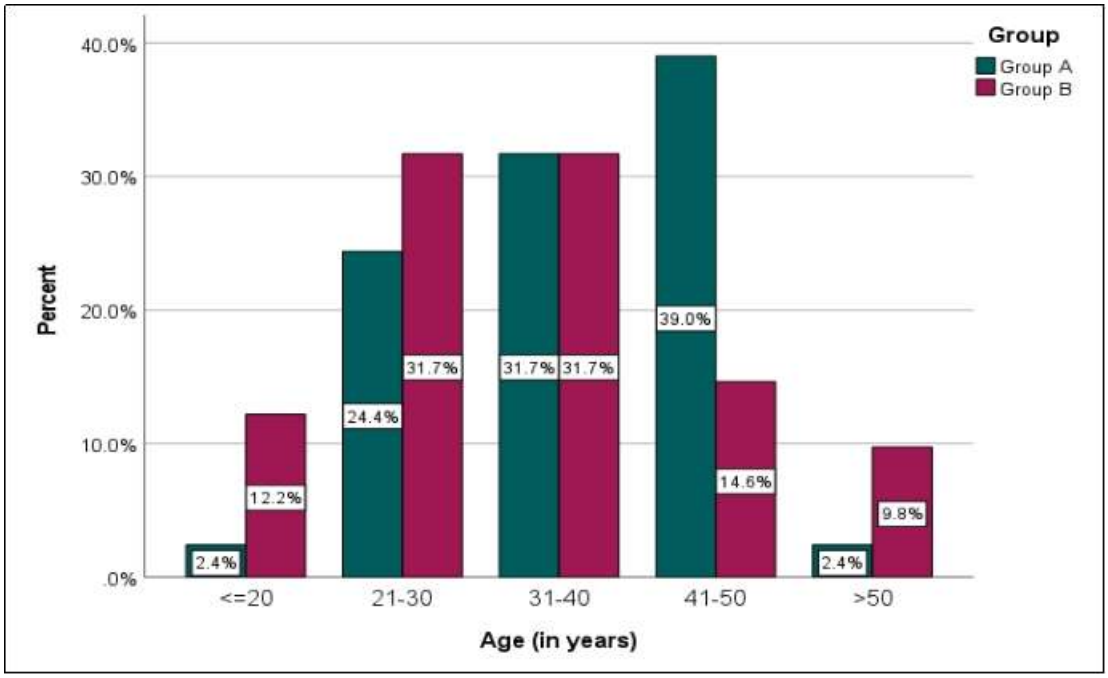
Pre-anesthetic physical examinations, which included all standard investigations, were performed on every patient. As premedication, 150 mg of ranitidine and 0.25 mg of alprazolam were administered one hour before to the scheduled surgery. After the patient had written informed permission, the operation was described to them. Following the patient's transfer to the operating room, the mean arterial pressure and heart rate were measured at baseline. Prior to the subarachnoid block, each patient had an IV preload of 10 millilitres per kilogram of lactated Ringers solution after gaining access to the IV. The patient was placed in a seated posture and a 25 gauge Quicken needle was aseptically put intrathecal via the L3-L4 intervertebral area using a midline route. Following a dural puncture that was successful, an anaesthetic solution was delivered. No more analgesics are given unless the patient reports pain.

Results

Table 1: Age Distribution

Age (in years)	Group A(Magnesium Sulphate)		Group B (Fentanyl)		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<=20	1	2.4%	5	12.2%	6	7.3%
21-30	10	24.4%	13	31.7%	23	28.0%
31-40	13	31.7%	13	31.7%	26	31.7%
41-50	16	39.0%	6	14.6%	22	26.8%
>50	1	2.4%	4	9.8%	5	6.1%
Total	41	100.0%	41	100.0%	82	100.0%
Mean ± SD	37.02±8.32		32.76±12.03		34.89±10.50	
t-value	1.868					
df	80					
P-value	0.065					

Figure 1: Age Distribution

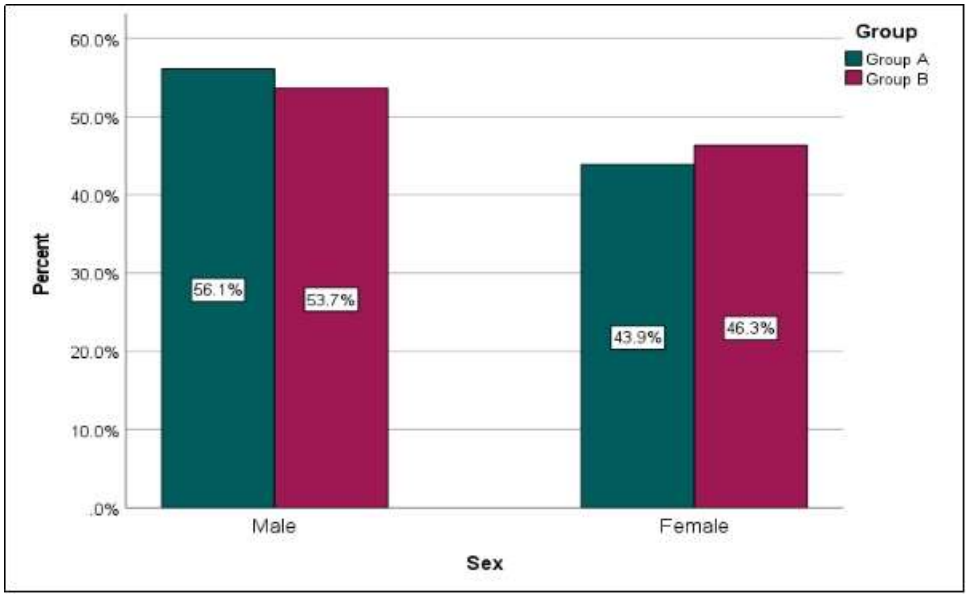


The mean age was 37.028.32, years in group A (Magnesium sulphate) and 34.89±10.50 years in group B (Fentanyl). The groups were comparable with p=0.065.

Table 2: Gender Distribution

Sex	Group A (Magnesium Sulphate)		Group B (Fentanyl)		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Male	23	56.1%	22	53.7%	45	54.9%
Female	18	43.9%	19	46.3%	37	45.1%
Total	41	100.0%	41	100.0%	82	100.0%
Chi-Square	0.049					
df	1					
P-value	0.824					

Figure 2: Gender Distribution

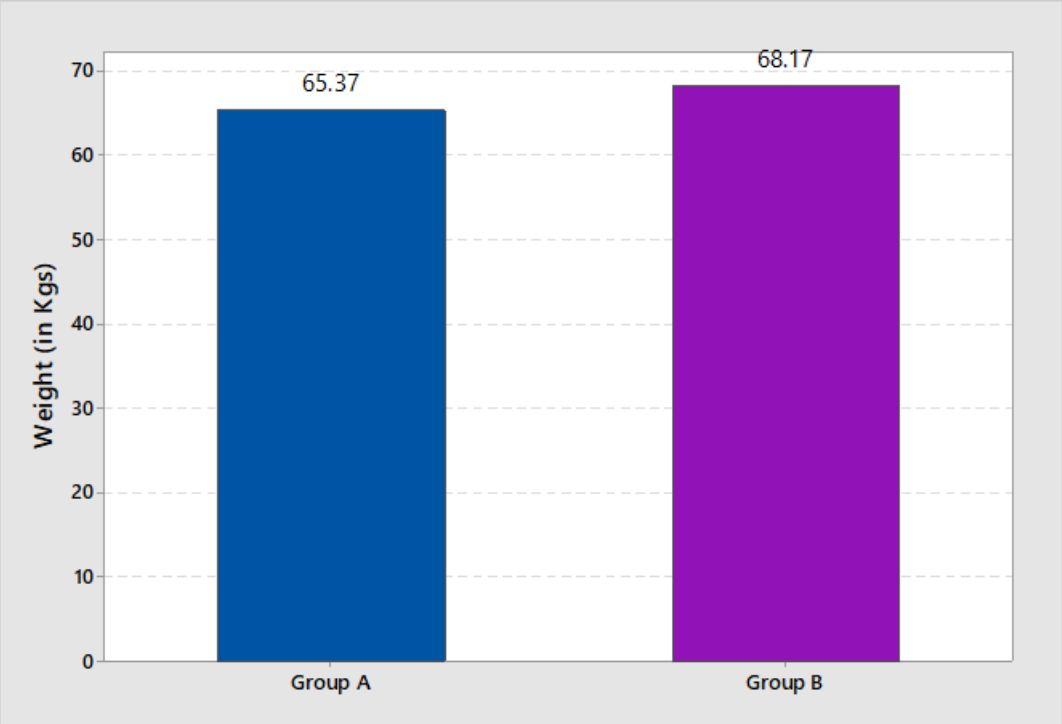


Male gender distribution was 56.1% in Group A (Magnesium sulphate) and 43.9% in Group B (Fentanyl)Female gender distribution was 53.7% in Group A (Magnesium sulphate) and 46.3% in Group B (Fentanyl) with p value of 0.824

Table 3: Comparison Of Weight Of Patients Between Groups

Group A (Magnesium Sulphate)		Group B(Fentanyl)		t-value	df	P-value
Mean	SD	Mean	SD			
65.37	8.837	68.17	11.27	-1.254	80	0.214

Figure 3: Comparison Of Mean Weight Of Patients between Groups

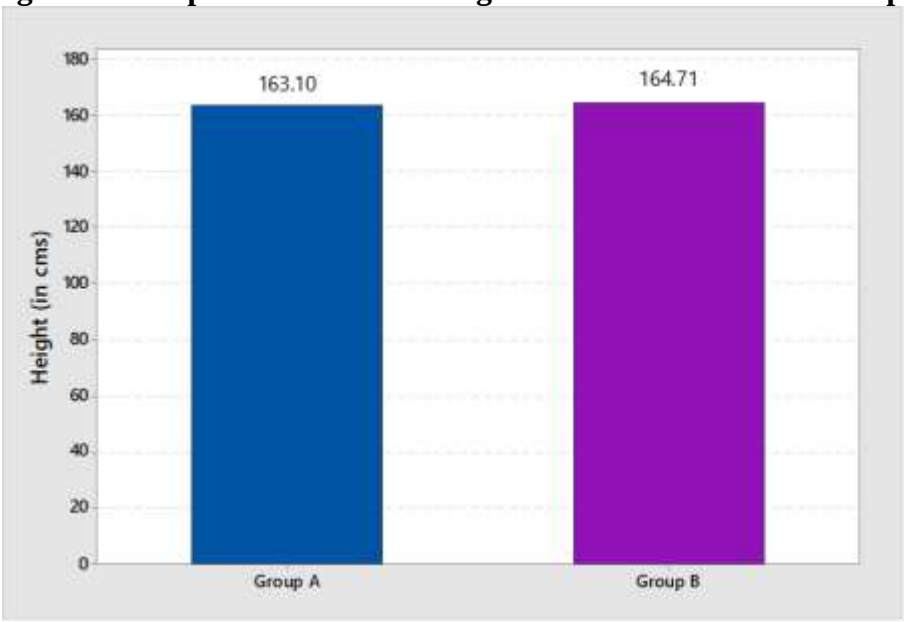


Mean weight in group A (Magnesium sulphate) was 65.37±8.837 Kg which was similar to group B (fentanyl) with mean weight of 68.17±11.27 kg and they were comparable.

Table 4: Comparison Of Height Of Patients Between Groups

Group A(Magnesium Sulphate)		Group B(Fentanyl)		t-value	df	P-value
Mean	SD	Mean	SD			
163.10	8.230	164.71	8.78	-0.856	80	0.394

Figure 4: Comparison Of Mean Height Of Patients Between Groups

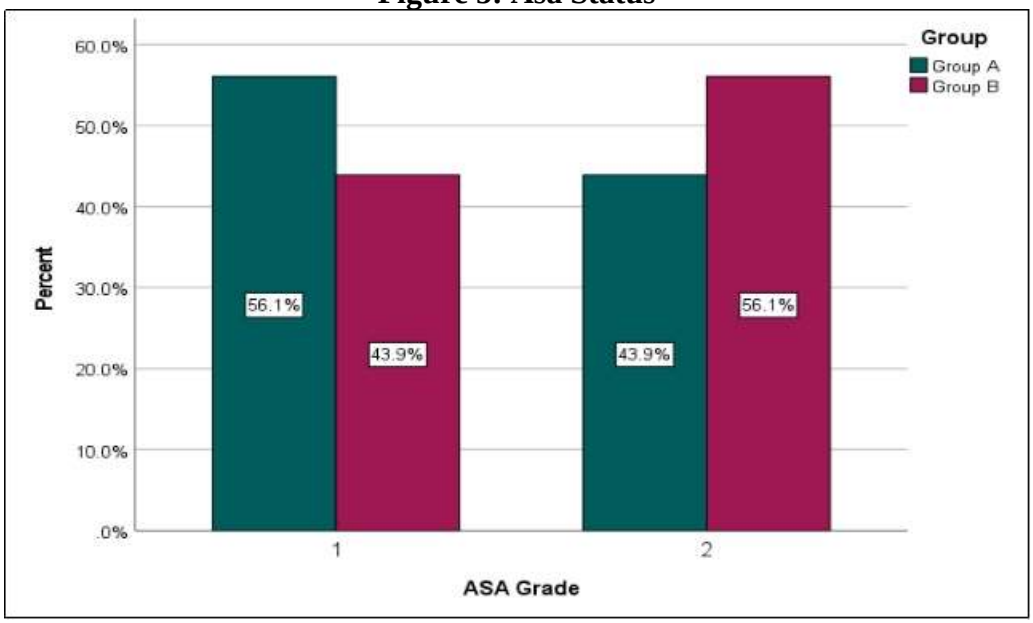


Mean height in group A (Magnesium sulphate) was 163.10±8.230 cms which was similar to group B (fentanyl) with mean height of 164.71±8.7 cm respectively and they were comparable

Table 5: Asa Status

ASA	Group A (Magnesium Sulphate)		Group B (Fentanyl)		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	23	56.1%	18	43.9%	41	50.0%
2	18	43.9%	23	56.1%	41	50.0%
Total	41	100.0%	41	100.0%	82	100.0%
Chi-Square	1.22					
df	1					
P-value	0.269					

Figure 5: Asa Status

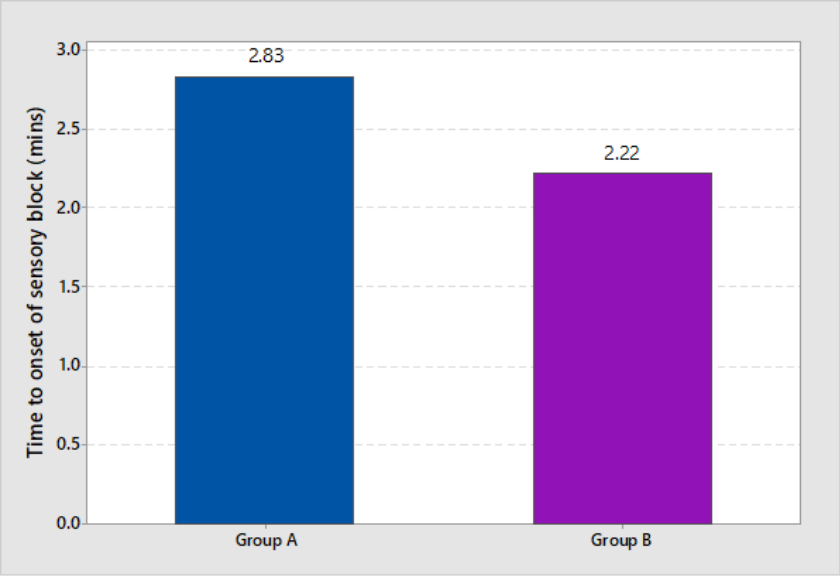


ASA- I distribution was 56.1% in Group A and 43.9% in Group B . ASA 2 group distribution was 43.9% in Group A and 56.1% in group B ASA status was comparable with p value of 0.269 .

Table 6: Time To Onset Of Sensory Block In Minutes

Group A(Magnesium Sulphate)		Group B(Fentanyl)		t-value	df	P-value
Mean	SD	Mean	SD			
2.83	0.803	2.22	0.72	3.608	80	0.001

Figure 6: Time To Onset Of Sensory Block In Minutes



The mean time to onset of sensory block at T10 was 2.83± 0.803 min group A (Magnesium sulphate) and it was 2.22 ± 0.72 min group B (Fentanyl). p value was 0.001 which was statistically significant. The onset of sensory blockade was delayed in Magnesium sulphate group when compared to fentanyl group.

Discussion

In our investigation, the length of sensory and motor blockade, as well as the start and degree of the block, were used to evaluate the effectiveness of spinal anaesthesia. We also contrasted the length of analgesia with the incidence of adverse reactions, including bradycardia, hypotension, shivering, nausea, and vomiting. We selected 82 patients who met the inclusion criteria for our trial; none of them had a block failure or dropped out. In both groups, the demographic parameters of height, weight, and sex were similar.

In our investigation, the time interval between the study medication injection and the patient's cessation of pinprick pain at T10 is considered the commencement of sensory blockage. The average time that a sensory block starts The durations for group A (magnesium sulphate) and group B (fentanyl) are 2.83±0.803 and 2.22±0.72 minutes, respectively, with a statistically significant p value of 0.001. Thus, the onset of sensory blocking was prolonged by the addition of magnesium sulphate to bupivacaine. ARORA et al. (3) also noted a comparable delay in the start of sensory block. They discovered that the pH and baricity differences in the magnesium sulphate solution may be the reason. It is defined in our study as the total number of patients who reached the highest level of sensory blockage (T10). The two groups' maximal sensory block levels were comparable, with a significant p value of 0.01. T10 maximal sensory block was reached by 9 patients in group A and 18 patients in group B out of 41 patients. When compared to the magnesium group, the fentanyl group reached a higher level of maximal sensory blackout.

It is described as the average time required to reach a Bromage score 1 motor block.With a statistically significant p value of 0.001, the mean time of motor block onset was 5.56±0.709 minutes for group A (magnesium sulphate) and 2.78±0.69 minutes for group B (fentanyl). This suggested that the fentanyl group experienced a faster start of motor blockage. It was comparable to a research by OZALEVLI et al. (20) in which isobaric bupivacaine and fentanyl were combined with intrathecal magnesium (we utilised hyperbaric bupivacaine in our investigation). In their investigation, group M took a median of 17 minutes to attain the greatest dermatome level of sensory block, while group S took a median of 13 minutes ($p < 0.05$).

In group A (magnesium sulphate), it was 5.22±0.50 hours, and in group B (fentanyl), it was 5.51±0.69 hours. The p value of 0.34 indicated that the results were not significant. It bore similarities to ARICONI (10) et al.'s study, in which a 100 mg dosage of magnesium extended the duration of analgesia and reduced the need for

postoperative analgesics. Compared to magnesium sulphate, fentanyl caused a motor blockage that lasted longer. The mean duration of motor block was found to be 2.99± 0.44 hours for group A (fentanyl) and 1.95± 0.36 hours for group B (magnesium), with a p-value of less than 0.05. Comparing various dosages of fentanyl and magnesium sulphate as adjutants to bupivacaine for infra umbilical procedures under subarachnoid block was a research conducted by SARIKA KATIYAR(1) et al. and published in the Indian Journal of Anaesthesia,

August of 2015.There were four groups of thirty patients each out of the 120 individuals who were enrolled in the research. Group B received 15 mg of heavy bupivacaine combined with 100 milligrammes of magnesium (total volume: 3.5 ml) while Group A received 15 mg of heavy bupivacaine combined with 25 µg of fentanyl.Both groups received magnesium via insulin syringe as needed, and the magnesium was diluted to 0.5 ml with sterile water. Group D received 15 mg of 0.5% heavy bupivacaine together with 50 mg of magnesium, while Group C received 15 mg of heavy bupivacaine along with 0.5 ml of normal saline. They discovered that adding fentanyl 25 µg or magnesium sulphate at a dosage of 100 mg as an adjuvant to intrathecal bupivacaine greatly extended the duration of analgesia.

We monitored heart rate and mean arterial pressure for 120 minutes following the subarachnoid block in our trial. Despite the fact that a statistically significant p value was acquired every 2 minutes for the first 10 minutes, every 5 minutes for the next 30 minutes, and finally every 10 minutes until the procedure was finished. The last reading was taken ten minutes after the surgery, and the mean heart rate was within the normal range at all times—25, 30, 45, and 60 minutes later. Bradycardia or tachycardia were not seen in any cases. The fentanyl group experienced higher hypotension than the magnesium group. Group B (fentanyl) had a 12.19% incidence of hypotension. However, no patient in group A (magnesium) experienced appreciable hypotension.

Conclusion

In contrast to the addition of fentanyl, the current study's findings indicate that the intrathecal start of sensory and motor blockade was delayed by the addition of 100 mg magnesium sulphate to 0.5% hyperbaric bupivacaine. Furthermore, when added at a dosage of 100 mg, magnesium sulphate prolongs the duration of analgesia to an equivalent degree as fentanyl, but with a stable hemodynamic profile and fewer adverse effects.

Reference

1. Katiyar S, Dwivedi C, Tipu Jain RK. Comparision of different doses of magnesium sulphate fentanyl as adjuvant to bupivacaine for infraumblical surgeries under subarachnoid block. Indian JAnaesth2015;59:471-5.
2. A.P.Morrison , J.M.Hunter, S.H.Halpern and A Banarjee. Effect of intrathecal magnesium in the presence or absence of local anesthetic with and without lipophilic opioids: a systemic review and meta-analysis.British Journal of Anaestesia110 (5): 702-12.
3. Arora B, Pathak DG, Tarat A, Sutradhar D, Nath R, Shekand B. Comparison of intrathecal magnesium and fentanyl as adjuvant to hyperbaric bupivacaine in preeclampsia parturient undergoingelective cesarean sections. J Obstet Anaesth Crit Care2015;5:9-15
4. Yadav M, Kumar PB, Singh M, Gopinath R. Intrathecal magnesium sulfate as a spinal adjuvant in two different doses, combined with 0.5% heavy bupivacaine for infraumblical surgeries. Anaesth EssaysRes2015; 9:364-8.

5. Jabalameli M, Pakzadmoghadam SH. Adding different doses of intrathecal magnesium sulfate for spinal anesthesia in the cesarean section: A prospective double blind randomized trial. Adv. Biomed Res2012;1:7.
6. Binesh Kathuria,NeeruLuthra, AnnachalGupta, AnjuGrewal, DineshSood. Comparativeefficacy of two different dosages of intrathecal magnesium sulphate supplementation in subarachnoidblock.Journal of Clinical and Diagnostic Reasearch.2014 Jun. Vol-8(6).GC01-GC05.
7. Khandelwal M, Dutta D, Bafna U, Chauhan S, Jetley P, Mitra S. Comparison of intrathecal clonidine and magnesium sulphate used as an adjuvant with hyperbaric bupivacaine in lower abdominal surgery. Indian JAnaesth2017;61:667-72.
8. SinghR,KundraS, GuptaS, GrewalA, TewariA. Effectofclonidineand/orfentanylincombination with intrathecal bupivacaine for lower limb surgery. J Anaesthesiol ClinPharmacology2015;31:485-90.
9. Asokumar Bhuvanendran, Robert J. McCartthy, Jeffery S kroin, Worren Leong, Patricia Perry, Kenneth J. Tuman. Intrathecal Magnesium Prolongs Fentanyl Analgesia: A prospective, Randomized,ControlledTrial. Anaesth Analag. 2002;95:661-6.
10. Marzich-Beigom Khezri, Siamk Yaghobi, Masha Hajjikhani, Saeid Asefzadeh Comparison of postoperative analgesic effect of intrathecal magnesium and fentanyl added to bupivacaine in patientsundergoing lower limb orthopedic surgery.ActaAnaestesiology Taiwania50(2012)19-24.
11. RoutraySS, Raut K, Pradhan A, Dash A, Soren M. Comparison of intrathecal clonidine and fentanyl as adjuvant to hyperbaric bupivacaine in subarachnoid block for lower limb orthopedic surgery. AnesthEssays Res 2017;11:589-93.
12. Khandelwal, M., Ahmed, F. and Sharma, A. (2017). A comparative study of the effect of clonidine, fentanyl, and the combination of both as adjuvant to intrathecal bupivacaine for postoperative analgesia in total abdominal hysterectomy. Journal of Anaesthesiology Clinical Pharmacology, 33(1),p.102.
13. Collins Principles of Anaesthesiology, fourth edition ; Spinal anaesthesia principles; Philadelphia Lea and Febiger 1993;1470
14. Stoelting RK.Opioid Agonists and Antagonists. In: Pharmacology and Physiology in Anaesthetic Practice. Philadelphia, Lippincott Raven 1999; 93-96.
15. Atkinson RS, Rushman GB, Davies NJH, In Lee's synopsis of Anaesthesia-Fourteenth Edition;Buttworth-Heinman publication:700-03.anaesthesia, London,Lloyd-Luke1984;
16. Morgan clinical anaesthesiolog;6th edition; Spinal ,epidural and caudal blocks; Wayne Kleinman and Maged Mikhail;Lange medical books;Mcgraw-Hill309
17. Harold Ellis anatomy for Anaesthetistst; ninth edition; The vertebral canal and its contents; Blackwell publishing;125
18. Hodgson PS, Neal JM, Pollock JE, Liu SS. The neurotoxicity of drugs given intrathecally (Spinal).Anaesthesia and Analgesia ; 88:797-809.
19. Covino BG.Pharmacology of local anaesthetic agents. British Journal of Anaesthesia 1986; 58:701-716. Anaesthesiology.; 81(6); 1493-98.
20. Ozalevli M, Cetin TO, Unlugenc H, Guler T, Wasik G. The effect of adding intrathecal magnesium sulphate to bupivacaine-fentanyl spinal anaesthesia. Acta Anaesthesiol Scand ;49:1514-9.