Original Article

Synergistic effects of intrathecal magnesium sulphate to the combination of bupivacaine and fentanyl spinal anaesthesia in patients undergoing lower abdominal surgeries

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Abstract

Background: Local anesthetics are extremely useful drugs for anaesthesiologists. All modern local anesthetics are amides. Esters are unstable in its solution. Lignocaine, Prilocaine, Bupivacaine etc all shares a common basic structure termed aminoacylamide. The current study aims to evaluate the effects of intrathecal supplementation of magnesium sulphate to bupivacaine-fentanyl in patients undergoing lower abdominal surgeries**. Methodology:** The patients were randomly assigned into two groups of 40 patients each, to receive an intrathecal injection in sitting position of either 15mg of 0.5% hyperbaric bupivacaine + 20mcg i.e 0.4ml of fentanyl + 0.1mg (0.1ml) 50% of magnesium sulphate or 15mg of 0.5% hyperbaric bupivacaine + 20mcg i.e. 0.4ml of fentanyl + 0.1ml normal saline. Duration of motor blockade, time taken for two segments regression are noted. **Results:** Duration of motor blockade was higher in Group A compared to Group B (279.25+53.33 vs. 249.75+45.11, $p<0.001$). Regression of sensory block to S_1 was significantly earlier in Group B compared to Group A (240.13±58.99 vs. 271.25±56.78, $p<0.001$). **Conclusion**: Longer time for two segment regression, longer duration of motor blockade,decrease incidence of adverse effects.

Keywords: Hyperbaric bupivacaine; Magnesium sulphate; Fentanyl; Lower abdominal surgeries; Spinal anaesthesia.

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Received Date: 19/06/2016 Revised Date: 15/07/2016 Accepted Date: 05/08/2016

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 09 August 2016

INTRODUCTION

Spinal anaesthesia may be defined as the temporary interruption of transmission of the nerve impulses across the nerve fibers by injecting drug into the sub arachnoid space. Subarachnoid block is the anaesthetic technique of choice for lower abdominal surgeries. Effective treatment of perioperative pain represents an important component of postoperative recovery as it is known to blunt autonomic, somatic and endocrine reflexes with a resultant potential reduction in perioperative morbidity.[2] Spinalanaesthesia have been shown to blunt the "stress response" to surgery,[3] to decrease intraoperative blood loss,[4,5]to reduce the incidence of postoperative thromboembolic events,[4-7] and to decrease morbidity and mortality in high-risk surgical patients.[8,9] Local anaesthetics supplemented with opioids are found to have synergistic effect.[10,11] Morphine was the first opioid to be used intrathecally in combination with local anaesthetics[10,11] but was associated with slower onset of action and risk of delayed respiratory depression because of its hydrophilic nature. The use of intrathecal fentanyl, a lipophilic opioid, with bupivacaine was described by Hunt *et al* in 1989.[11] Techniques involving the smaller doses of opioid in combination with non-opioid adjuvant drugs are becoming increasingly popular approaches for perioperative pain management. Noxious stimulation leads to release of glutamate and aspartate neurotransmitters, which bind to various subclasses of

How to site this article: Mallikarjuna *et al.* Synergistic effects of intrathecal magnesium sulphate to the combination of bupivacaine and fentanyl spinal anaesthesia in patients undergoing lower abdominal surgeries. *International Journal of Recent Trends in Science and Technology* August 2016; 20(1): 46-48 http://www.statperson.com (accessed 11 August 2016).

excitatory amino acid receptors, including the N-methyl D-aspartate (NMDA) receptor.[13] Activation of NMDA receptors leads to calcium and sodium influx into the cell, with an efflux of potassium and initiation of central sensitization and wind-up.[14,15] NMDA receptor signaling may be important in determining the duration and intensity of postoperative pain. Magnesium blocks NMDA channels in a voltage-dependent way, and the addition of magnesium produces a reduction of NMDA-induced currents.[16] Thus it has anti-nociceptive effect and has application in anaesthesia. It has various actions such as analgesia, vasodilation by calcium block, and inhibition of catecholamine release.

The current study aims to evaluate the effects of intrathecal supplementation of magnesium sulphate to bupivacaine+fentanyl in patients undergoing lower abdominal surgeries.

MATERIAL AND METHODS

After our Hospital Research and Ethics Committee approval, informed written consent was be obtained from 80 patients, ASA physical status I or II and of 150-170 cms height scheduled for elective lower abdominal surgeries under spinal anesthesia were included in this prospective, randomized, double-blinded study. The patients were randomly assigned into two groups of 40 patients each, to receive an intrathecal injection in sitting position of either 15mg of 0.5% hyperbaric bupivacaine + 20mcg i.e 0.4ml of fentanyl + 0.1mg (0.1ml) 50% of magnesium sulphate or 15mg of 0.5% hyperbaric bupivacaine + 20mcg i.e. 0.4ml of fentanyl + 0.1ml normal saline.

Statistical Analysis

Descriptive and inferential statistical analysis was used in our study. Results on continuous measurements were presented on Mean± (Min-Max) and results on categorical presented in Number (%). Student t test (two tailed, dependent) was used to find the significance of study parameters on continuous scale within each group. Chi square/ Fisher Exact test was used to find the significance of study parameters on categorical scale between two or more groups. Significance was assessed at 5 % level of significance(P).

OBSERVATIONS AND RESULTS

Table 1: Sample distribution according to age group (in years)

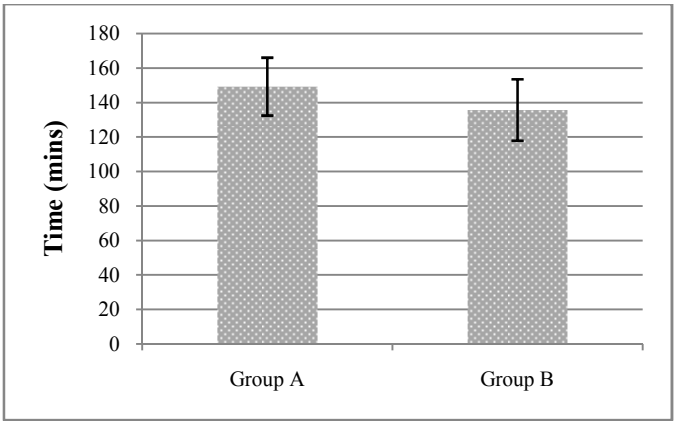
	Group A	Group B
Mean±SD	49.62±9.20	48.67±11.05
p value	0.669	

Table 2: Sample distribution in the groups according to ASA Grade

ASA	Group A		Group B	
	N	%	N	%
Grade 1	15	37.5%	18	45%
Grade 2	25	62.5%	22	55%
Total	**40**	**100%**	**40**	**100%**
p value	0.4957			

Table 3: Time taken for regression of sensory block by two segments (mins)

Groups	Mean±SD	p value
Group A	149.13±16.79	0.001*
Group B	135.63±17.80	



Graph 1: Mean time for regression of sensory block by two segments in the group

Table 4: Duration of motor block (mins)

Groups	Mean±SD	p value
Group A	279.25±53.33	0.009*
Group B	249.75±45.11	

Table 5: Adverse effects

Adverse effects	Group A		Group B		Total
	#	%	#	%	
Hypotension	2	22.2	1	12.5	3
Bradycardia	3	33.3	1	12.5	4
Nausea	1	11.1	2	25.0	3
Vomiting	0	0.0	0	0.0	0
Shivering	3	33.3	3	37.5	6
Pruritis	0	0.0	1	12.5	1
Total adverse effects	**9**	**22.5**	**8**	**20.0**	**17**
p-Value	0.7334				

DISCUSSION

Subarachnoid block is a commonly employed anaesthetic technique for performing lower abdominal and lower limb surgeries. It is a safe, inexpensive andeasy-to-administer technique. This technique also offers a high level of post–anaesthesia satisfaction for patients. It is simple, has rapid onset and is reliable. The risk of general anaesthesia and mishaps due to airway management are avoided by this technique.[7] Fentanyl citrate is a synthetic phenylpiperdine opioid agonist that is structurally related to meperidine. As an analgesic, fentanyl is 75 to 125 times more potent than morphine.[6]

Intrathecal administration of fentanyl produces selective spinal analgesia (SSA) by acting on opioid receptors at substantiagelatinosa of dorsal horn of spinal cord. Magnesium sulphate is an effective spinal adjuvant. It is voltage dependent blocker of the NMDA channels which improve quality and duration of spinal analgesia.[9] NMDA receptors are regulated by the physiological concentrations of extracellular magnesium ions. Stimulation of the nociceptive neurons leads to activation of the glutamate postsynaptic receptors. This leads to an inflow of ions, particularly calcium (Ca^{2+}) into the intracellular space, producing a hyperexcitable state in the neuron.

CONCLUSION

In patients undergoing lower abdominal and lower limb surgeries, addition of 50% of 50 mg of magnesium sulphate to the combination of intrathecal bupivacaine and fentanyl, the following conclusions are drawn:

1. Longer time for two segment regression.
2. Delays time for complete motor recovery without significant haemodynamic variations and side effects.
3. There was minimal side effects noted and reduced analgesic requirement in early postoperative period.

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Source of Support: None Declared
Conflict of Interest: None Declared