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The comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to bupivacaine

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Abstract

Introduction: Spinal anaesthesia provided by bupivacaine may be to short for providing postoperative analgesia. This study is conducted for the understating and calculation of the efficacy of intrathecal fentanyl and intrathecal dexmedetomidine as an adjuvant to hyperbaric bupivacaine with regards to the onset duration of sensory and motor blockade.

Material & Method: 200 patients were taken with difference age group and classified into two groups. Both group consist 100 patients and given spinal anaesthesia using bupivacaine 0.5%, heavy 2.5 ml with either fentanyl 25µg (group A) or 5µg of preservative free dexmedetomidine (group B).

Result: During sedation we take proper measurement of major vital organ such as taken pulse rate, respiratory rate, blood pressure, and arterial oxygen saturation were obtained. After operation patient analgesia time were recorded.

Keywords: Bupivacaine, dexmedetomidine, fentanyl, spinal anaesthesia

Introduction

Spinal anesthesia is one of the most common anesthetic procedures in lower limb and also in lower abdomen surgery, most commonly it used because of its easy to administer ^[1]. There is some advantage of this method including patients wakefulness, rapid onset effect low failure rate, low-dose drug, desirable sensory and motor blocks and affordability ^[2]. Spinal anesthesia also showing some side effects like hypotension, bradycardia, nausea, vomiting. For reducing side effect it is possible giving to lay the patient in the lateral position and rotate the bevel of needle to the bottom and inject the hyperbaric local anesthetics slowly for its turbulent movement of the local anesthetics in the CSF ^[3]. The addition of fentanyl to hyperbaric bupivacaine improves the quality of intraoperative and early postoperative subarachnoid block ^[4]. The identification of opioid receptors in the spinal cord can proved the potent analgesic effects of neuraxial opioids which have been exploited to improve perioperative analgesia and it reduce the supraspinal side effects of sedation and respiratory depression seen with systemic opioids ^[5]. However the addition of opioids in local anesthetic solution did not showing any advantages, like pruritus and respiratory depression. Dexmedetomidine, a new highly selective α_2 -agonist, it is under evaluation as a neuraxial adjuvant for provides stable hemodynamic conditions, good quality of intraoperative and prolonged postoperative analgesia and it showing less side effects ^[6]. It has been approved by FDA as a short-term sedative for mechanically ventilated for intensive care unit patients ^[7]. Fentanyl is a synthetic, lipophilic phenylpiperidine opioid agonist with an analgesic which showing anesthetic properties. Fentanyl selectively binds and it activates the mu-receptor in the central nervous system and it start mimicking the effects of endogenous opiates. The Activation of the mu-subtype opioid receptor stimulates the exchange of GTP for GDP on the G-protein complex and it subsequently inhibits the action of adenylate cyclase. Due to which there are decrease in intracellular cAMP which inhibits cAMP-mediated and it affect calcium influx into the cell via the calcium channels due to which there is the hyperpolarization take place and it reduced neuronal excitability ^[8]. There were very few studies found in which comparing between intrathecal dexmedetomidine and fentanyl as adjuvants to hyperbaric bupivacaine. In such case we need some study for knowing the best effective anesthetic drug for lower abdomen and lower limb surgery.

Materials and Methods

The present study was conducted in Anesthesia department at National Institute of medical science and research Jaipur Rajasthan

There was total 200 patient were taken for the study. All patient were divided in to 2 group each group consist 100 patient and name of the group1 & group 2.

Group 1(100) patients received 2.5mL volume of 0.5% hyperbaric bupivacaine with 25g fentanyl intrathecally and Group 2(100) (n=50) received 2.5mL volume of 0.5% hyperbaric bupivacaine and 5g dexmedetomidine in 0.5mL of normal saline intrathecal (dexmedetomidine 100g/mL was diluted in 10ml preservative-free normal saline). Duration of study period was may 2021 to December 2021.

Given parameters were noted:

1. Onset of sensory blockade and motor blockade.
2. Total duration of analgesia noted.
3. Side effects if any are noted.

Haemodynamic monitoring was done regularly in every short interval of time till the end of surgery and it was also observed post operatively.

These parameter were Monitoring

1. Mean arterial pressure (MAP),
2. SpO₂ hourly.
3. Systolic blood pressure (SBP)
4. ECG
5. Diastolic blood pressure (DBP),
6. Heart rate (HR),

For the Sensory Blockade: we will calculated time taken from the completion of the injection till then the patient does not complaining any pain.

Time Taken for Maximum Sensory Blockade: it can be defined as for drug for maximum sensory blocked.

Duration of Analgesia: it can be defined as the time duration in complete injection of drug to reduced pain for post-operative period.

It is measure by Analogue Scale Score on a 10cm scale:

1. Grade 0:0 No pain.
2. Grade 1:1–2.5 Mild Pain.
3. Grade 2:2.6–5 Moderate Pain.
4. Grade 3:5.1–7.5 Severe Pain.
5. Grade 4:7.6–10 Worst possible pain.

Duration of Sensory Blockade: the time duration between injection till the patient loss its complete recovery from the sensation loss.

Duration of Motor Blockade: the time duration between patient for attains complete motor recovery.

Statistical Analysis: Statistical analysis was performed by using computer based software, Statistical Package for Social Science (SPSS).

Observation and Results

The all patients were divided in to 2 groups 1 & 2 by randomized computer selection and it divided patients in to group, group 1 and group 2. Group 1 (100) received 2.5mL volume of 0.5% hyperbaric bupivacaine with 25g fentanyl intrathecally and Group (100) received 2.5mL volume of 0.5% hyperbaric bupivacaine and 5g dexmedetomidine in 0.5mL of normal saline intrathecal (dexmedetomidine 100g/mL was diluted in 10ml preservative-free normal saline).

Table 1: Showing the mean difference between group 1 and group 2 patients

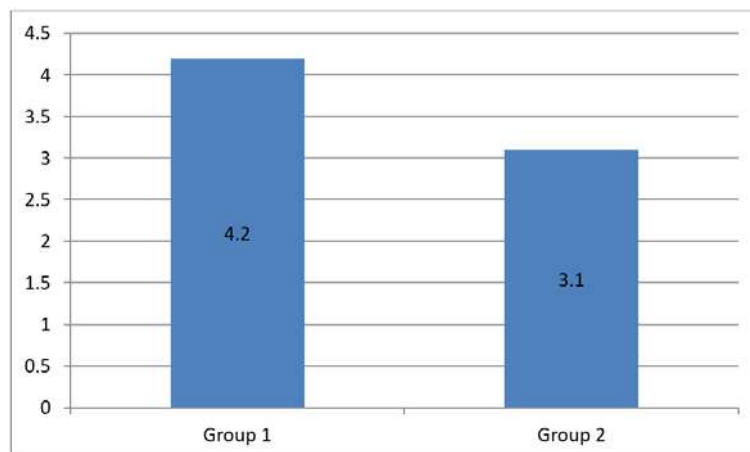
	Group 1	Group 2
Age year	42	48
Height	164	170
Weight	70	75
Duration of Surgery	190	192
Hysterectomy	10	20
Inguinal hernia	20	30
Urinary bladder and ureteric surgery	30	10
Cholecystectomy	40	40

Table 2: Showing Feature of sensory block

	Group 1	Group 2
Highest sensory level	T5 (T4-T8)	T5 (T4-T8)
Time from injection to highest sensory- level (min)	11.3±1.8	11.3±1.8
Time of two segment regression from the highest 118±10 sensory- level (min)	120±10	70±10
Time of segment regression to S1 from the highest 470±10 sensory- level (min)	450±9	145±10
Total analgesic dose in first 24h (mg)	80±12	195±40
Time to rescue analgesia (min)	220±10	150±45
Onset to bromage 3 (min)	12±45	12±45
Regression to Bromage 0 (min)	500±10	200±40

Table 3: Showing the mean sedation score

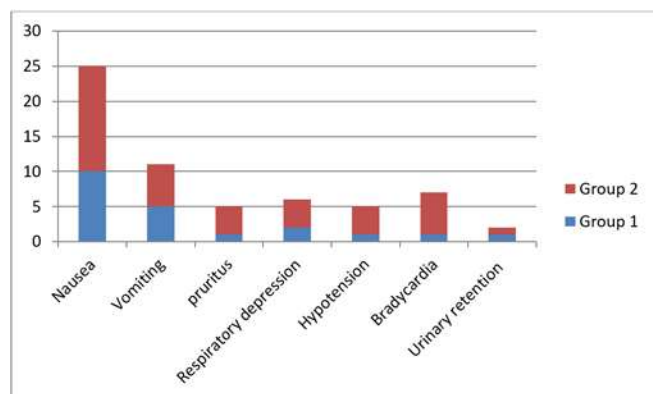
Mean sedation score	
Group 1	4.2
Group 2	3.1



Bar graph 1: showing the mean sedation score in both group 1 & group 2

Table 4: Showing the side effects in both group

	Group 1	Group 2
Nausea	10	15
Vomiting	5	6
pruritus	1	4
Respiratory depression	2	4
Hypotension	1	4
Bradycardia	1	6
Urinary retention	1	1



Bar graph 2: Showing the side effects in both group.

Discussion

The mechanism of spinal anesthetic is not well understand but they act on binding to presynaptic C – fibres and postsynaptic dorsal horn neuron which causes motor and sensory block. There are many known analgesic action is but most of do depression by release of c- fibres transmitters and hyperpolarisation of the postsynaptic dorsal horn neurons [9]. Local anesthetic works as the blocking of sodium channels which act as prolong effect this showing by the synergism between local anesthetic and α_2 -adrenoceptor agonist, while the prolongation of the motor block in spinal anesthetics may result from the binding of α_2 - adrenoceptor agonists in motor neurons in the dorsal horn [10]. Fukushima *et al.* they administered 2 $\mu\text{g}/\text{kg}$ epidural dexmedetomidine for postoperative analgesia in humans but did not report any neurologic deficits [11]. While in our study we add 5 μg dexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block and we find Both fentanyl and dexmedetomidine provided good quality intraoperative analgesia and hemodynamic stability. The analgesia was clinically better in group A as compared to group B. Small doses of

intrathecal dexmedetomidine (3 μg) used in combination with bupivacaine in humans have been shown to shorten the onset of motor block and prolong the duration of motor and sensory block with hemodynamic stability and they show lack of sedation also [7]. Al-Ghanem *et al.* had studied and show the effect on addition of 5 μg dexmedetomidine or 25 μg fentanyl intrathecal to 10 mg isobaric bupivacaine in vaginal hysterectomy and found that 5 μg dexmedetomidine produces more prolonged motor and sensory block as compared with 25 μg fentanyl [12]. While comparing with our study we found group a has longer duration of both sensory and motor blockade stable hemodynamic condition, and good patient satisfaction. Al-Mustafa *et al.* studied and observed that dexmedetomidine 5 and 10 μg with bupivacaine in urological procedures and found that dexmedetomidine prolongs the duration of spinal anesthesia in a dose-dependent manner [13]. Bogra J *et al.* studied and observed that Visceral pain usually occurs during abdominal surgery under spinal anesthesia but while adding the Intrathecal fentanyl in local anesthetics reduces visceral and somatic pain [14]. In both group A and B patient not showing any perceived visceral pain.

Conclusion

5 μg dexmedetomidine seems to be a very good alternative to 25 μg fentanyl as an adjuvant to spinal bupivacaine in surgical procedures. It provides a good quality of intraoperative analgesia, hemodynamically stable conditions, minimal side effects, and excellent quality of postoperative analgesia. Such more study need for knowing more about drug and its effect.

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