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ORIGINAL ARTICLE

A COMPARATIVE STUDY OF INTRATHECAL DEXMEDETOMIDINE AND FENTANYL AS ADJUVANTS TO BUPIVACAINE FOR INFRA-UMBILICAL SURGERIES

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ABSTRACT: BACKGROUND: Several adjuncts like adrenaline,opioids and alpha-2 adrenergic agonists are being used with local anaesthetics intrathecally for prolongation of intra-operative and post-operative analgesia and to reduce the side-effects of high doses of local anaesthetics.[1] **AIM:** The present study was done to evaluate the onset and duration of sensory and motor block, hemodynamic effects, post-operative analgesia and adverse effects of Dexmedetomidine or Fentanyl given intrathecally with hyperbaric 0.5% Bupivacaine. **MATERIALS AND METHODS:** Ninety inpatients of ASA class I and II scheduled for various infra-umbilical surgeries under Sub-Arachnoid Block were randomly divided into three groups of 30 each namely C (Control), D(Dexmedetomidine) and F(Fentanyl). All received 12.5mg hyperbaric bupivacaine plus 0.5 ml Normal Saline in **Group** C(Control),5 µ g Dexmedetomidine (diluted in preservative free Normal saline of 0.5ml) in **Group** D(Dexmedetomidine) and 25 µ g Fentanyl (vol 0.5 ml) in **Group F** (Fentanyl). The onset time to reach peak sensory and motor level, the regression time for sensory and motor block, hemodynamic changes and side-effects were noted. **RESULTS:** The duration of sensory and motor block,rescue analgesia was significantly prolonged in Dexmedetomidine group when compared to that of the Fentanyl group which is longer than that of Control group. **CONCLUSION:** Dexmedetomidine 5 µg seems to be better than 25µg Fentanyl as a neuraxial adjuvant to hyperbaric Bupivacaine.
KEYWORDS: Dexmedetomidine, intrathecal, fentanyl, hyperbaric bupivacaine.

INTRODUCTION: Many adjuncts such as adrenaline, opioids, midazolam, clonidine etc., were added to the local anesthetics given intrathecally to avoid intra-operative visceral and somatic pain and also prolong the post-operative analgesia [1]. Therefore, the present study is an attempt to explore the usefulness and compare this newer alpha-2 adrenergic agonist Dexmedetomidine as a neuraxial adjuvant with Fentanyl.

MATERIALS AND METHODS: Ninety inpatients, scheduled for major infra-umbilical surgeries under Sub-Arachnoid Block (SAB), at King George Hospital, Visakhapatnam were chosen for the study.Inclusion Criteria is ASA physical status class I,II and 18-60 years of either sex. Exclusion Criteria are emergency surgery, deformities of the spine, hypersensitivity to any of the drugs in the study, contraindications to spinal anaesthesia like patient refusal, bleeding diathesis, heart block/dysrrhythmia and therapy with Adrenergic Receptor Antagonist, Calcium Channel Blocker or ACE Inhibitor.

The protocol of the study was approved by the scientific search committee of the medical college and written consent was obtained pre-operatively. Patients were premedicated with Tab.Rantac 150 mg and Tab. Anxit 0.5 mg H.S.All patients were preloaded with 15 ml/ Kg, Ringer's

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Lactate, 15 mins before the surgery and randomly allocated into three groups of 30 each namely C(Control), D (Dexmedetomidine) and F(Fentanyl). Baseline vitals were recorded. Under strict asepsis, using 25 G Quincke spinal needle, lumbar puncture was performed at L 3 – L 4 interspace in sitting position.

Group C (Control) received 3ml, 0.5% hyperbaric bupivacaine (2.5ml)+ 0.5 ml Normal Saline.

Group D (Dexmedetomidine) received 3ml, 0.5 % hyperbaric bupivacaine (2.5ml) + 5 µ g Dexmedetomidine (diluted in preservative free Normal saline of 0.5ml).

Group F (Fentanyl) received 3ml, 0.5 % hyperbaric bupivacaine (2.5ml) + 25 µ g Fentanyl (vol 0.5 ml).

Immediately after giving the intrathecal injection over 10-15sec approximately, the patients were made to lie supine. Intra-operatively pulse rate, non- invasive blood pressure and SpO2 were recorded at 0, 2, 5, 10, 20, 30, 40, 50, 60, 90, 120, 180 minutes continued till the end of surgery.

Time of onset of sensory block to T10 level and maximum sensory level achieved were noted using pin prick method. Time of onset to Bromage 3 motor block was noted too. The onset of sensory block was defined as the time between injection of intrathecal anesthetic and the absence of pain at the T10 dermatome assessed by sterile pinprick every 2 min till T10 dermatome was achieved. The highest level of sensory block was evaluated by pinprick at midclavicular line anteriorly every 5 min for 20 min after the injection, thereafter every 15 min. The duration of sensory block was defined as the time of regression by two segments in the maximum block height, evaluated by pinprick. Motor block was assessed with Modified Bromage scale. Time for onset of motor block was defined as modified Bromage score of 3. Complete motor block recovery was assumed when modified Bromage score was 0. Modified Ramsay sedation scale was used for intraoperative sedation.

Hypotension (> 30 % fall from baseline blood pressure) was treated with a bolus dose of 6 mg mephenteramine IV. Bradycardia (pulse rate < 50 bpm) was treated with 0.6 mg atropine IV. Incidence of respiratory depression defined as respiratory rate less than 9/min and SpO2 less than 90 % on room air. Any other side effects were noted. Post-operatively, regression of the sensory block and the time to reach modified Bromage 0 was noted. Pain was assessed using “Visual Analogue Scale” advocated by Revill and Robinson in 1976. It is linear scale consisting of 10 cm line anchored at one end by a label such as “No pain” and other end by “Worst pain imaginable”. 0=no pain, 10=severe pain. Rescue analgesia Inj.Diclofenac 50mg was given intramuscularly when VAS was more than 4.Total number of rescue analgesics in the first 24hrs postoperative period was noted.(Each Rescue Analgesic equals to 50mg Inj. Diclofenac IM).

STATISTICAL ANALYSIS: Data obtained was coded and entered into Microsoft Excel spreadsheet. Descriptive statistical analysis has been carried out in the present study. The categorical data was expressed in terms of percentage and continuous data was expressed as mean ± standard deviation (SD). The data was analysed by One-way Analysis of Variance (ANOVA) using SPSS 20.0 version and Kruskal Wallis Test. For a probability value (p value) of less than or equal to 0.05 was considered as statistically significant. p value more than 0.05 was considered statistically insignificant.

RESULTS: The groups were comparable with respect to age, height, and weight. The time of onset of sensory and motor block is similar in all the three groups. Mean sedation score is slightly more in Dexmedetomidine group than that of Fentanyl and Control groups but of no statistical significance.

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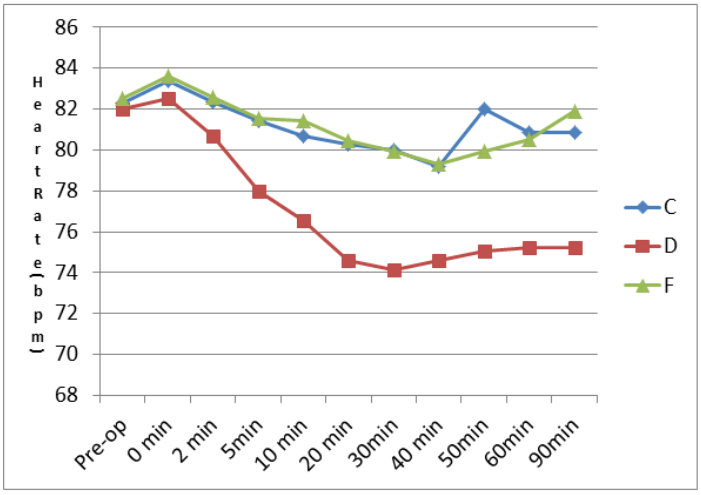
The duration of sensory and motor block, time for rescue analgesia were significantly prolonged in Dexmedetomidine group when compared to that of the Fentanyl group which is longer than that of Control group. The total number of rescue analgesics in the first 24hrs post-op was significantly low for the Dexmedetomidine group compared to the other two groups. Mean heart rate and mean arterial pressure were shown in the graph-1 and 2 below. Hypotension and bradycardia were more in the Dexmedetomidine group than the other two groups but it is not of statistical significance. Other side-effects like nausea, vomiting, respiratory depression, pruritus and urinary retention were not noticed in any of the groups as seen in the Table-1 below.

	C	D	F	p value
Age(yr)	38.50±12.48	42.60±12.36	38.40±12.36	>0.05
Height(cm)	162.67±2.8	162.97±2.6	162.63±2.7	>0.05
Sensory onset to T10(min)	2.63±0.71	2.87±1.04	3.07±0.64	>0.05
Time to maximum sensory level T6(min)	11.17±1.66	11.5±3.27	10.97±2.81	>0.05
Time to Bromage 3	9.43±1.3	9.57±2.23	9.87±2.5	>0.05
Sedation score	2	2.23±0.43	2	<0.05*
Sensory regression by 2segments(min)	53±6.24	143.67±21.08	84.73±18.32	<0.001**
Regression to Bromage 0(min)	107.17±8.67	314.67±20.12	136.9±18.73	<0.001**
Sensory regression to S1 from max sensory level	148.33±8.16	372.33±28.48	174.23±17.56	<0.001**
Rescue analgesia(min)	128.33±8.33	267.33±22.58	164.83±19.6	<0.001**
Number of rescue analgesics in 24hr post-op	6.07±0.86	2.5±0.5	4.3±0.65	<0.001**

Table 1: Demographic data and characteristics of sensory and motor block

*significant, **highly significant.



Graph 1: Comparison Of Mean Heart rate at Different Durations

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Graph 2: Comparison of MAP At Different Durations In The Three Groups

DISCUSSION: Fentanyl, a lipophilic opioid in small doses (25 micrograms) added to the local anaesthetics in spinal anaesthesia produces a more rapid onset surgical block of better quality (than local anaesthetic agents alone), and leads to a more rapid recovery of motor function which then allows a quicker discharge post-surgery.[2,3] Intrathecally, it exerts its effect by combining with opioid receptors in the dorsal horn of spinal cord and may have a supraspinal spread and action.[4]

Alpha-2 adrenergic agonists are being evaluated extensively as an alternative to neuraxial opioids, as an adjuvant.[5] Dexmedetomidine, a highly selective α2Adrenergic Receptor agonist with a relatively high ratio of α2/α1-activity (1620:1 as compared to 220:1 for clonidine), has a synergistic effect when added to intrathecal local anaesthetics.[6] It hastens the onset of motor block, provides stable intra-operative hemodynamics, enhances and extends sensory and motor blockade. It also prolongs post-operative analgesia in a dose dependent manner.[7] Intrathecal Dexmedetomidine when combined with spinal bupivacaine prolongs the sensory block by depressing the release of C-fiber transmitters and hyperpolarisation of post-synaptic dorsal horn neurons.[8] Local anaesthetics act by blocking sodium channels. The prolongation of effect may result from synergism between local anaesthetic and α 2-adrenoceptor agonist. The prolongation of motor block may result from a)binding of α 2-adrenoceptor agonists to motor neurons in the dorsal horn of the spinal cord.[9] b) Direct impairment of excitatory aminoacid release from spinal interneurons.[10] Intrathecal α 2-receptor agonists have been found to have antinociceptive action for both somatic and visceral pain.[11]

From Kanazi et al,[12] Kalso et al[4] and Post et al[13] studies,it is evident that 3-5µg Dexmedetomidine would be equipotent to 30-45µg Clonidine when used as a neuraxial adjuvant to Bupivacaine.[14] Intrathecal Fentanyl prolongs the duration of spinal anaesthesia produced by Bupivacaine.[14] Clinical studies demonstrated that a dose of 25µg Fentanyl in spinal anaesthesia produces excellent quality of peri-operative analgesia. Based on the above studies,Fentanyl in a dose of 25µg was used as an adjuvant with hyperbaric Bupivacaine in this study.[15,16,17]

Al Ghanem et al[14] studied the effect of adding Dexmedetomidine and Fentanyl to intrathecal isobaric bupivacaine (10mg) in gynaecological procedures. They concluded that 5µg Dexmedetomidine produced prolonged motor and sensory block compared with 25µg Fentanyl.

In the present study,it was observed that in the dexmedetomidine group there was longer duration of both sensory and motor blockade, stable hemodynamic condition, and good patient satisfaction.

CONCLUSION: Intrathecal Dexmedetomidine as an adjuvant to bupivacaine produces significant prolongation of sensory and motor blockade. It also provides good quality of intra-operative analgesia, hemodynamic stability with minimal side effects and excellent post-operative analgesia. Thus, 5µg Dexmedetomidine seems to be an attractive alternative to 25µg Fentanyl as a neuraxial adjuvant to hyperbaric Bupivacaine in infra-umbilical surgeries.

However, prolonged duration of motor blockade with dexmedetomidine may be undesirable for ambulatory surgeries. This study includes the young and otherwise healthy patients and the effects in older patients with cardiovascular comorbidities are yet to be investigated. Further studies proving its efficacy and safety determining the suitable dosages are required. It also lacks an active control for systemic Dexmedetomidine effect. Hence, further studies that compare the effect of intrathecal and IV dexmedetomidine on the spinal bupivacaine may also be warranted.

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