

A Comparative Study of Intrathecal Fentanyl and Dexmedetomidine as Adjuvants to Bupivacaine

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ABSTRACT

Introduction: Spinal anaesthesia is the most preferred regional anaesthesia technique. Present study was done to study the efficacy of Intrathecal Fentanyl and Dexmedetomidine with 0.5% heavy Bupivacaine for infra umbilical surgeries.

Materials and Methods: 100 patients belonging to ASA physical status I & II of both sexes were divided into two groups of 50 each. Group F received 3ml Inj.0.5% Bupivacaine heavy with 25 micrograms of Fentanyl and Group D received 3ml Inj 0.5% Bupivacaine heavy with 5 micrograms of Dexmedetomidine. The time of onset of sensory and motor block, haemodynamic status, duration of analgesia and adverse effects if any were compared in both the groups.

Results: Time from injection to highest sensory level and Onset of Bromage 3 was similar in both groups. Time from injection to T10 sensory level was significantly shorter in Group D ($p<0.001$), and Time for regression to Bromage 0 was significantly longer in group D ($p<0.001$). Intraoperatively both groups remained haemodynamically stable. Incidence of bradycardia was more in Group D and incidence of pruritus was more in Group F though it was not statistically significant ($p=0.402$). Intraoperative sedation was higher in Group D ($p<0.001$) and post operatively Visual analogue scores were significantly lower with group D ($p<0.001$)

Conclusion: Dexmedetomidine appears to be an attractive adjuvant to intrathecal bupivacaine than Fentanyl as there is significantly longer duration of motor block, additional benefits of intraoperative sedation and decreased analgesic requirement in the post-operative period.

Keywords: Intrathecal; bupivacaine; fentanyl; dexmedetomidine; bromage; sedation

longs the duration of spinal block.

Therefore, the present study was performed to compare Fentanyl and Dexmedetomidine in their efficacy as adjuvants to sub arachnoid block.

MATERIALS AND METHODS

A randomised controlled study was done in 100 patients, posted for major surgeries, below umbilical level, in Kakatiya Medical College and M.G.M Hospital.

Inclusion Criteria

ASA physical status class I and II, Age between 18 – 65 years of either sex.

Exclusion Criteria

Emergency surgery, Deformities of the spine, Hypersensitivity to any of the drugs in the study, Contraindications to spinal anaesthesia – patient refusal, bleeding diathesis.

After approval from the ethical committee of our college, Pre-operative assessment was done and further evaluated for any systemic diseases. Laboratory investigations recorded. The procedure of spinal anaesthesia was explained to the patients and written consent was obtained. The patients were educated about the use of visual analogue scale. Preparation of patients included period of overnight fasting. Patients were premedicated with Tab.Ranitidine 150 mg and Tab. Alprazolam 0.5 mg H.S.

Preparation Of Operating Theatre

Boyle's anaesthesia machine was checked. Appropriate size endotracheal tubes, working laryngoscope with medium and large size blades, stylet and working suction apparatus were

INTRODUCTION

Spinal anaesthesia is the most preferred regional anaesthesia technique as it is easy to perform, economical and produces rapid onset of anaesthesia and complete muscle relaxation. The aim of intrathecal local anaesthetic is to provide adequate sensory and motor block necessary for all infra umbilical surgeries. Hyperbaric bupivacaine is the most commonly used intrathecal local anaesthetic.

Various adjuvants have been added to bupivacaine to shorten the onset of block and prolong the duration of block. Fentanyl, a lipophilic opioid agonist, is used as an adjuvant, which prolongs the duration of spinal block. Dexmedetomidine, an α -2 agonist drug, when given intrathecally, significantly pro-

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kept ready before the procedure. Emergency drug tray consisting of atropine, adrenaline, mephenteramine, ephedrine and dopamine were kept ready.

Group F received 3ml, 0.5 % hyperbaric bupivacaine + 25 µg Fentanyl (vol 0.5ml) Group D received 3ml, 0.5 % hyperbaric bupivacaine + 5 µg Dexmedetomidine (vol 0.5 ml). Intraoperatively pulse rate, non-invasive blood pressure, electrocardiogram, SpO₂ was recorded, every 2 minutes for the first 10 minutes, every 10 minutes for the next 50 minutes and every 15 minutes till the end of surgery. Time of onset of T₁₀ sensory block and peak sensory block was noted using pin prick method, time of onset of Bromage 3 motor block was noted.

Motor block was assessed with Modified Bromage scale

Bromage 0 - the patient is able to move the hip, knee and ankle

Bromage 1 - the patient is unable to move the hip but is able to move the knee and ankle

Bromage 2 - the patient is unable to move the hip and knee but able to move the ankle

Bromage 3 - the patient is unable to move the hip, knee and ankle.

Modified Ramsay sedation scale was used for intraoperative sedation

- = agitated, restless
- = cooperative, tranquil
- = responds to verbal commands while sleeping
- = brisk response to glabellar tap or loud noise while sleeping
- = sluggish response to glabellar tap or loud noise while sleeping
- = no response to glabellar tap or loud noise while sleeping

Following parameters were recorded

Hypotension (> 20 % fall of baseline blood pressure) was treated with bolus dose of 6 mg ephedrine i.v.

Bradycardia (pulse rate < 50 bpm), was treated with 0.6 mg atropine i.v.

Incidence of respiratory depression defined as respiratory rate less than 9 /min and SpO₂ less than 90 % on room air, was noted. Side effects if any were noted. Post operatively regression of the sensory block and the motor blockade 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, consists of 10 cm line anchored at one end by a label such as "No pain" and other end by "Worst pain imaginable". Patient simply marks the line to indicate the pain intensity. Supplemental analgesia was given for visual analogue score of more than 6. Time of supplemental analgesia was noted.

Visual analogue scale was used to assess post-operative pain.

Statistical analysis

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Statistical analysis was done by applying Chi-square test, Anova test and students 't' test to analyse the data, p value was determined.

RESULTS

Age in years	Group F		Group D	
	No	%	No	%
18-20	2	4.0	0	0.0
21-30	3	6.0	4	8.0
31-40	13	26.0	26	52.0
41-50	22	44.0	14	28.0
51-60	8	16.0	5	10.0
>60	2	4.0	1	2.0
Total	50	100.0	50	100.0
Gender				
Male	25	50.0	25	50.0
Female	25	50.0	25	50.0
Total	50	100.0	50	100.0
ASA grade				
Grade I	26	52.0	31	62.0
Grade II	24	48.0	19	38.0
Total	50	100.0	50	100.0
Distribution of ASA grade is statistically similar in two groups with P = 0.41				

Table-1: Demographic distribution of patients studied

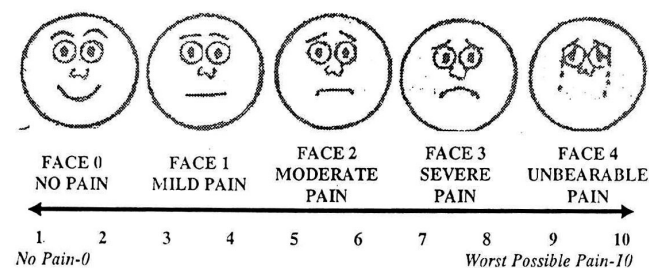


Figure-1: Visual analogue scale

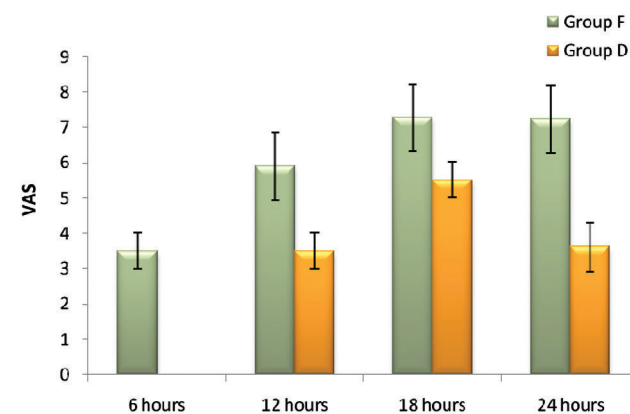


Figure-2: Comparison of Visual analogue scale of two groups

Surgery	Group F (n=50)		Group D (n=50)	
	No	%	No	%
Vaginal hysterectomy	10	20.0	11	22.0
Abdominal hysterectomy	8	16.0	1	2.0
ORIF	7	14.0	10	20.0
TURP	3	6.0	1	2.0
URS	2	4.0	3	6.0
Mesh repair	3	6.0	1	2.0
Below knee procedure	2	4.0	3	6.0
Stripping and ligation	3	6.0	1	2.0
Tension band wiring	2	4.0	1	2.0
Implant removal	0	0.0	2	4.0
Interval appendectomy	0	0.0	2	4.0
Fistula repair	0	0.0	1	2.0
Screw fixation	0	0.0	1	2.0
Skin grafting	0	0.0	1	2.0
Internal urethrotomy	1	2.0	1	2.0
DHS	1	2.0	0	0.0
Others	8	16.0	10	20.0

Table-2: Surgery in two groups of patients studied

Variables	Group F	Group D	P value
Time from injection to T10 (minutes)	3.38±0.83	2.62±0.56	<0.001
Time from injection to highest sensory level (minutes)	11.47±1.23	11.72±1.23	0.314
Onset of Bromage 3(minutes)	10.38±1.08	10.59±1.00	0.317
Regression to bromage 0(minutes)	152.90±8.31	419.70±16.85	<0.001

Table-3: Comparison of variables in the study

Highest sensory level	Group F		Group D	
	No	%	No	%
T8	0	0.0	19	38.0
T7	12	24.0	2	4.0
T6	16	32.0	14	28.0
T5	7	14.0	1	2.0
T4	15	30.0	14	28.0
Total	50	100.0	50	100.0

Table-4: Highest sensory level of patients studied

Side effects	Group F (n=50)		Group D (n=50)	
	No	%	No	%
Nausea	3	6.0	0	0.0
Vomiting	1	2.0	0	0.0
Pruritus	3	6.0	0	0.0
Hypotension	14	28.0	8	16.0
Bradycardia	0	0.0	7	14.0
Urinary retention	0	0.0	0	0.0
Respiratory depression	0	0.0	0	0.0

Table-5: Side effects of patients in two groups studied

DISCUSSION

Spinal anaesthesia is the most preferred regional anaesthesia technique as it is easy to perform, produces rapid onset

of anaesthesia and complete muscle relaxation and is also economical. These advantages are sometimes offset by a relatively short duration of action.

The aim of intrathecal local anaesthetic is to provide adequate sensory and motor block necessary for all infra umbilical surgeries. Hyperbaric bupivacaine is the most commonly used intrathecal local anaesthetic. Various adjuvants have been added to bupivacaine to shorten the onset of block and prolong the duration of block.

Fentanyl, a lipophilic opioid agonist, is used as an adjuvant, which prolongs the duration of spinal anaesthesia. Fentanyl is a lipophilic μ -receptor opioid agonist. Intrathecally, Fentanyl exerts its effect by combining with opioid receptors in the dorsal horn of spinal cord and may have a supraspinal spread and action.⁵

Dexmedetomidine, an α -2 agonist drug, when given intrathecally, significantly prolongs the duration of spinal anaesthesia. Intrathecal α -2 receptor agonists have been found to have antinociceptive action for both somatic and visceral pain.⁶ Therefore, the present study was performed to compare Fentanyl and Dexmedetomidine in their efficacy as adjuvants to spinal anaesthesia. In our study, the intrathecal dose of Dexmedetomidine selected was based on previous animal studies. A number of animal studies conducted using intrathecal Dexmedetomidine at a dose range of 2.5-100 μ g did not report any neurologic deficits with its use.

In our study design Group F received 0.5% of hyperbaric Bupivacaine 3ml with Fentanyl 25 μ g and Group D received 0.5% hyperbaric Bupivacaine 3ml with Dexmedetomidine 5 μ g, injected intrathecally to the patients undergoing infraumbilical surgeries. Time of onset of action, Highest level of sensory and motor blockade, Time of onset of Bromage 0, Intraoperative heart rate, Blood pressure, SpO₂, Intraoperative sedation, Regression to Bromage 3 and Post-operative requirement of analgesia were noted.

Kanazi et al.⁷ found that 3 μ g Dexmedetomidine or 30 μ g clonidine added to 13 mg spinal bupivacaine produced the same duration of sensory and motor block with minimal side effects in urologic surgical patients. From Kanazi study and animal studies, we assumed that 3-5 μ g Dexmedetomidine would be equipotent to 30-45 μ g clonidine when used for supplementation of spinal bupivacaine.

Our study has shown that the addition of 5 μ g Dexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block. Both Fentanyl and Dexmedetomidine provided good quality intraoperative analgesia. The analgesia was clinically better in group D as compared to group F. Small doses of intrathecal Dexmedetomidine (3 μ g) 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 haemodynamic stability and lack of sedation.

Al-Ghanem et al.⁸ had studied the effect of addition of 5 μ g Dexmedetomidine or 25 μ g Fentanyl intrathecal to 10 mg isobaric bupivacaine in vaginal hysterectomy and concluded

that 5 µg Dexmedetomidine produces more prolonged motor and sensory block as compared with 25 µg Fentanyl.

In our study, in the Dexmedetomidine group we found longer duration of both sensory and motor blockade and good patient satisfaction.

Al-Mustafa et al⁹ studied effect of Dexmedetomidine 5µg and 10 µg with bupivacaine in urological procedures and found that Dexmedetomidine prolongs the duration of spinal anaesthesia in a dose-dependent manner. Visceral pain usually occurs during abdominal surgery under spinal anaesthesia. Intrathecal Fentanyl when added to local anaesthetics reduces visceral and somatic pain. In our study also no patient perceived visceral pain in both D and F groups.

Rajni Gupta, Reetu Verma, Jaishri Bogra et al,¹⁰ used Dexmedetomidine as an intrathecal adjuvant for post-operative analgesia and found that the addition of 5 µg Dexmedetomidine to ropivacaine intrathecally produces prolongation in the duration of motor and sensory block. They also found that intraoperative ephedrine requirement was more in group D as compared to group R. In our study intraoperative incidence of hypotension was higher in group F.

Rajni Gupta, Reetu Verma, Jaishri Bogra et al,¹⁰ conducted a comparative study of intrathecal Dexmedetomidine 5µ gm and Fentanyl 25µ gm as adjuvants to bupivacaine and found that intrathecal Dexmedetomidine is associated with prolonged motor and sensory block, haemodynamic stability, and reduced demand for rescue analgesics in 24 hrs as compared to Fentanyl. In our study also the post-operative analgesic requirements was significantly less in the Dexmedetomidine group than group Fentanyl. They also found that the sedation score was more in group D patients. The mean sedation score was 3.8 ± 0.5 in group D as compared to 2.2 ± 0.53 in group F, which was statistically significant ($P < 0.05$). In our study the mean sedation score for group F was 2.16 ± 0.37 and group D was 3.40 ± 0.49 , which was statistically significant ($p < 0.001$)

There was no incidence of respiratory depression. Pruritus after intrathecal Fentanyl is known but it was not significant in the present study. The α -2 adrenergic agents also have antishivering property as observed by Talkeet al¹¹ and Maroof M et al.¹² We too did not find any incidence of shivering.

CONCLUSION

Addition of 5 µg Dexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block. Intraoperatively, there was less incidence of side effects with Intrathecal Dexmedetomidine when compared to Intrathecal fentanyl.

The post-operative 24 hours analgesic requirements was significantly less in the Dexmedetomidine group than group Fentanyl. To conclude, 5 µg Dexmedetomidine seems to be an attractive alternative to 25 µg Fentanyl as an adjuvant to spinal bupivacaine in surgical procedures. It provides good quality of intraoperative analgesia, haemodynamically sta-

ble conditions, minimal side effects, and excellent quality of postoperative analgesia.

Hence, Dexmedetomidine seems to be a better choice as Intrathecal adjuvant with Bupivacaine when compared with Fentanyl.

REFERENCES

1. F.J.M. Reynolds Wylie and Churchill Davidson Practice of Anaesthesia 5th Edition, P.G. Publishing Pvt. Ltd., 1986: 856-890.
2. Alfred Lee, Atkinson R.S., G. B. Rushman: A synopsis of Anaesthesia 10th Edition, K. M. Varghese Company, 1987: 663-713.
3. Nicholas M. Greene "Distribution of local anesthetic solution within the subarachnoid space", *Anesth Analg* 1985;64: 715 - 730.
4. B.R. Raymond Fink "Mechanisms of differential axial blockade in epidural and subarachnoid anaesthesia", *Anesthesiology*, 1989;70: 815-858.
5. AH Dickenson "Spinal cord pharmacology of pain", *Br. J Anesth* 1995;75:193-200.
6. Khan ZP, Ferguson CN, Jones RM. Alpha-2 and imidazole receptor agonists. Their pharmacology and therapeutic role. *Anaesthesia* 1999;54:146-65.
7. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, AlYaman R, et al. Effect of low-dose Dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. *Acta Anesthesiol Scand* 2006;50:222-7.
8. Al-Ghanem SM, Massad IM, Al-Mustafa MM, Al-Zaben KR, Qudaisat IY, Qataweh AM and Abu-Ali HM. Effect of Adding Dexmedetomidine versus Fentanyl to Intrathecal Bupivacaine on Spinal Block Characteristics in Gynecological Procedures: A Double Blind Controlled Study. *Am J Appl Sci* 2009;6:882-7
9. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA, Awwad ZM, et al. Effect of Dexmedetomidine added to spinal bupivacaine for urological procedures. *Saudi Med J* 2009;30:365-70.
10. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A Comparative study of intrathecal Dexmedetomidine and Fentanyl as adjuvants to Bupivacaine. *J Anaesthesiol Clin Pharmacol* 2011;27:339-43.
11. Talke P, Tayefeh F, Sessler DI, Jeffrey R, Noursalehi M, Richardson C. Dexmedetomidine does not alter the sweating threshold, but comparably and linearly reduces the vasoconstriction and shivering thresholds. *Anesthesiology* 1997;87:835-41.
12. Maroof M, Khan SA, Jain D, Khan RM, Maroof SM. Evaluation of effect of Dexmedetomidine in reducing shivering following epidural anaesthesia. *Anesthesiology* 2004;101: A495

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