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"A Comparative Study of Intrathecal Low Dose Bupivacaine and Dexmedetomidine with Low Dose Bupivacaine and Fentanyl"

DrRayees Ahmad, Dr Sherry Mathews, Dr N Satyanarayana
Sr Resident
Associate Professor
Prof and HOD
Dept of Anaesthesia Shadan Institute of Medical Sciences Hyderabad

Background and Aims: *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. . 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 prolongs 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.*
Methods-*100 ASA I and II patients scheduled for major surgeries under spinal anaesthesia were chosen for the study and divided into two groups.* ***Group F*** *received 3ml , 0.5 % hyperbaric bupivacaine + 25 µg Fentanyl (vol 0.5ml)* ***Group D*** *received 3ml, 0.5 % hyperbaric bupivacaine + 5 µgDexmedetomidine (vol 0.5 ml). Statistical analysis was done by applying Chi-square test, Anova test and students 't'test to analyse the data, p value was determined.*
Results *- Addition of 5 µgDexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block. The post operative 24 hours analgesic requirements was significantly less in the Dexmedetomidine group than group Fentanyl.*
Conclusions-*5 µgDexmedetomidine 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 stable conditions, minimal side effects, and excellent quality of postoperative analgesia.*
Key Words*:Intrathecal Bupivacaine,dexmedetomidine,fentanyl*

I. 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 prolongs the duration of spinal block[9].

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

II. Methodology

Inpatients, posted for major surgeries below umbilical level, in Shadan Institute of Medical Sciences, Teaching Hospital & Research Centre, Hyderabad were chosen for the study.The study period was from July 2015 to Nov 2015.

After approval from the ethical committee of our college, 100 ASA I and II patients scheduled for major surgeries under spinal anaesthesia were chosen for the study. Preanestheticcheck up was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded.The procedure of SAB 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.Rantac 150 mg and Tab. Anxit 0.5 mg H.S.

Patients shifted to OR table, IV access was obtained on the forearm with No 18G IV cannula and all patients were preloaded with 15 ml / Kg , Ringer's Lactate, 15 mins before the surgery.Patients were randomly allocated into two groups.Baseline vitals were recorded.Under strict asepsis, using 25 G Quincke spinal needle, lumbar puncture was performed at L 3 – L 4 space.

- Group F received 3ml , 0.5 % hyperbaric bupivacaine + 25 µg Fentanyl (vol 0.5ml)
- Group D received 3ml, 0.5 % hyperbaric bupivacaine + 5 µgDexmedetomidine (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

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

1 = agitated, restless
2 = cooperative , tranquil
3 = responds to verbal commands while sleeping
4 = brisk response to glabellar tap or loud noise while sleeping
5 = sluggish response to glabellar tap or loud noise while sleeping
6 = 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.iv
- 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.
  0 = no pain , 10 = severe pain.

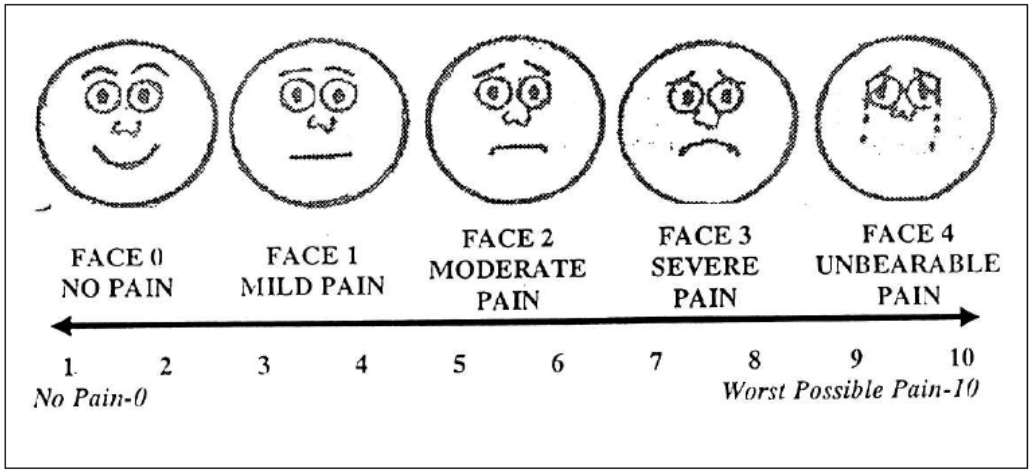


Figure 9: Visual analogue scale

Statistical Methods[29]: 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. The following assumptions on

data is made, Assumption: 1.Dependent variables should be normally distributed, 2.Samples drawn from the population should be random, Cases of the samples should be independent.

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

Study Design: A Comparative two group randomized clinical study with 100 patients with 50 patients in Group F(Fentanyl) and 50 patients in Group D(Dexmedetomidine) is undertaken to study the changes in haemodynamics and side effects.

Statistical analysis[28] was done by applying Chi-square test, Anova test and students 't' test to analyse the data, p value was determined.

P > 0.05 is not significant

P < 0.05 is significant

P < 0.001 is highly significant

III. Observations And Results

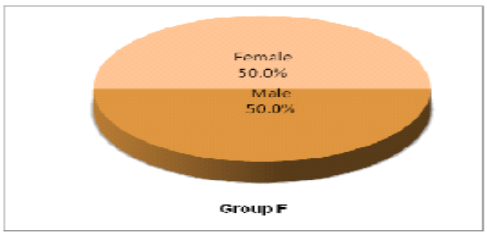
Table1: Age Distribution Of Patients Studied

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
Mean ± SD	43.76±10.33		40.86±9.27	

The patients who took part in this project were in the age group of 18 to 65 years. On statistical comparison the two groups were comparable

Table 2: Gender Distribution Of Patients Studied

Gender	Group F		Group D	
	No	%	No	%
Male	25	50.0	25	50.0
Female	25	50.0	25	50.0
Total	50	100.0	50	100.0



Shows gender distribution in both the groups and on statistical analysis we found that samples are gender matched

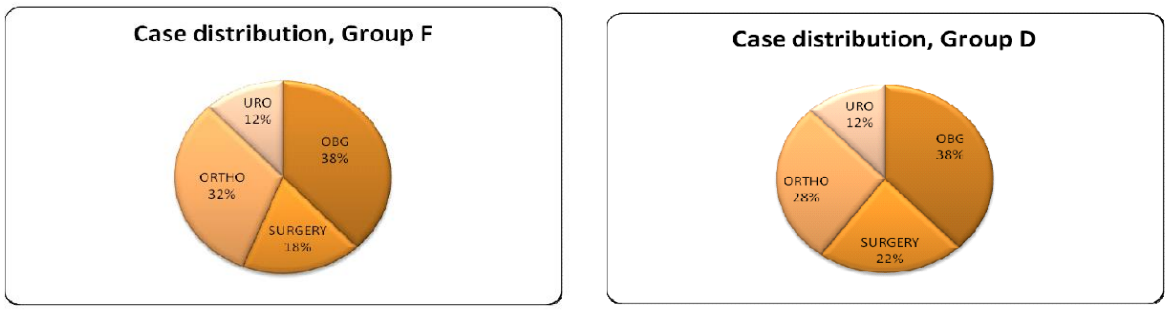
Table 3: Comparison of height and weight of two groups

Variables	Group F	Group D	P value
Height (cm)	155.66±5.16	156.10±5.83	0.690
Weight (kg)	58.12±12.35	56.90±10.18	0.591

Table 4: ASA grade in two groups of patients studied

ASA grade	Group F		Group D	
	No	%	No	%
Grade I	26	52.0	31	62.0
Grade II	24	48.0	19	38.0
Total	50	100.0	50	100.0

Graph 5 : Types of surgeries in both groups



Distribution of ASA grade is statistically similar in two groups

Table 6: Comparison of Time of Injection to T10, Highest sensory level, onset of Bromage 3 and regression to Bromage 0

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 7: Highest sensory level of patients studied

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 8: Comparison of Systolic Blood Pressure (mmHg) in two groups of patients Studied

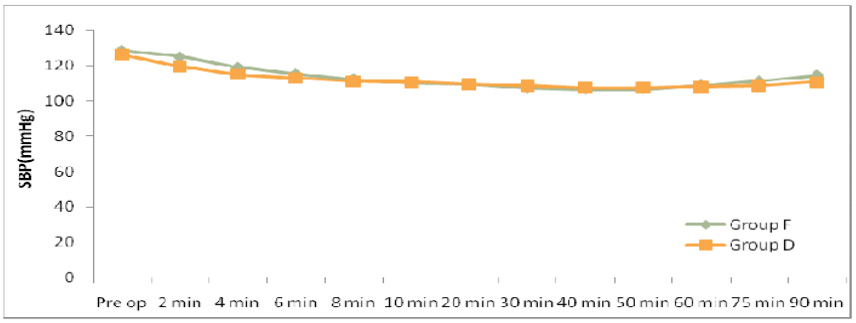


Table 9: Comparison of Diastolic Blood Pressure (mmHg) in two groups of patients Studied

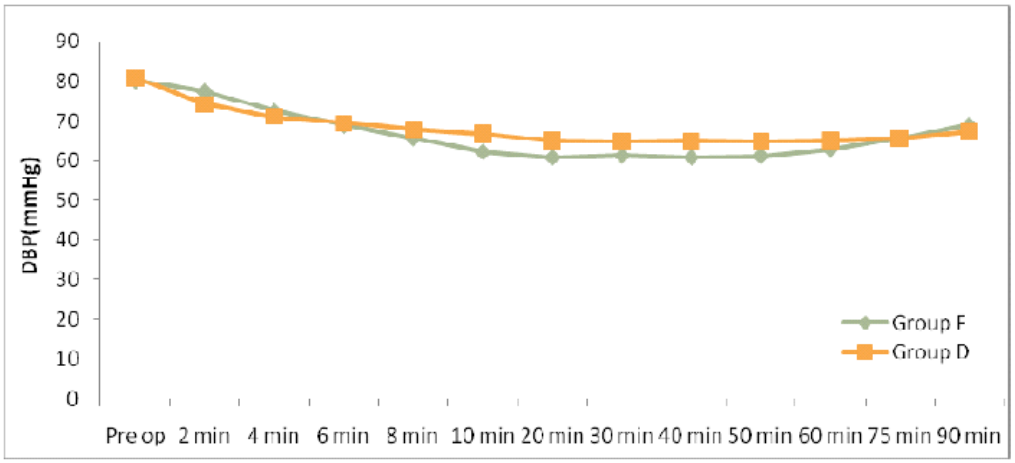


Table 10: Comparison of MAP (mmHg) in two groups of patients studied

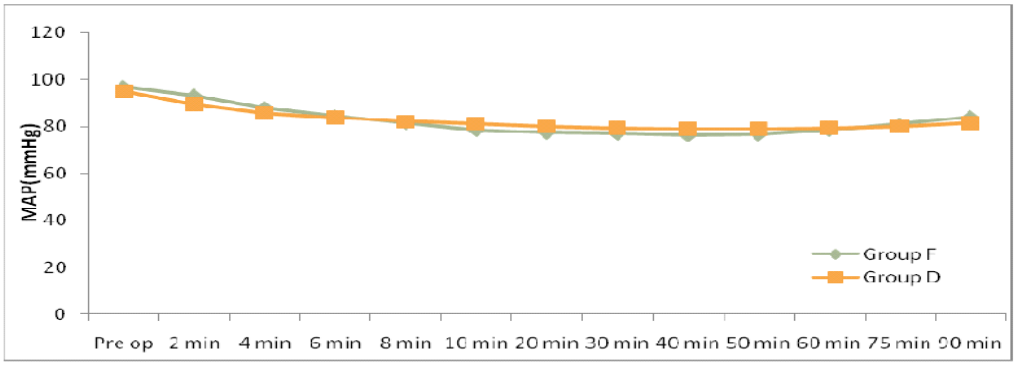


Table 11: Comparison of Heart Rate (beats per minute) in two groups of patients Studied

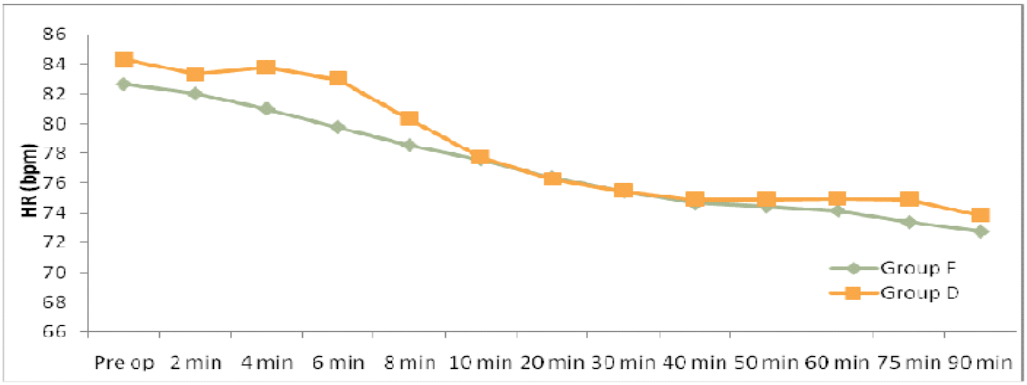


Table 12: Comparison of RR and SPO2 of two groups

Variables	Group F	Group D	P value
Respiratory rate(RR)	16.10±1.61	16.10±1.61	1.000
SPO2	97.92±0.75	97.92±0.75	1.000

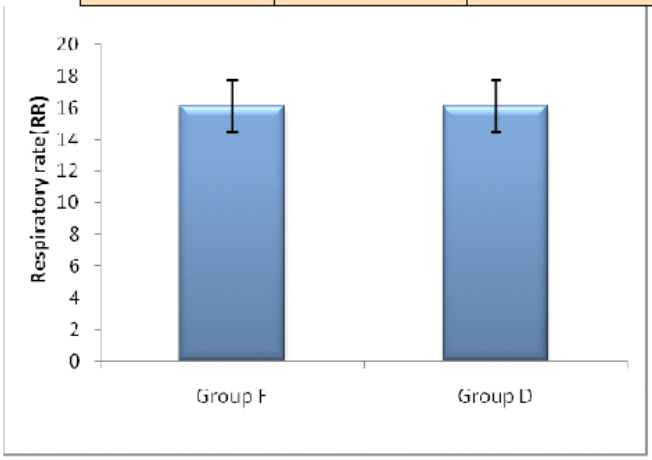


Table 13: Side effects of patients in two groups studied

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 14: Comparison of MODIFIED RAMSAY SEDATION SCORE of two groups

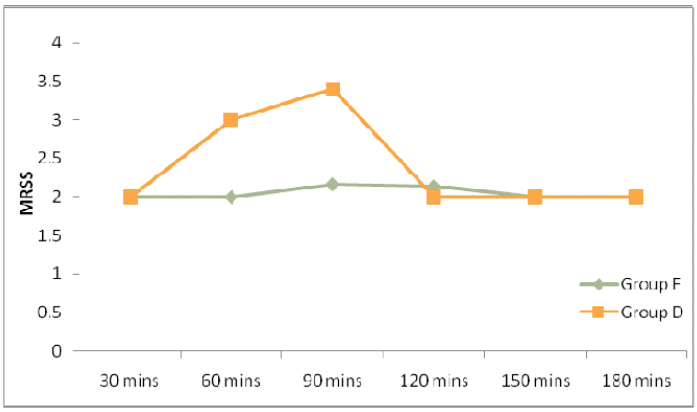
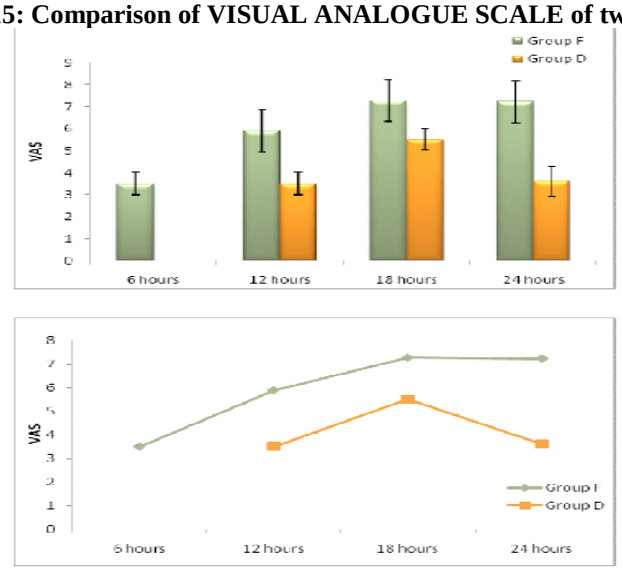


Table 15: Comparison of VISUAL ANALOGUE SCALE of two groups



IV. 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 anesthetic is to provide adequate sensory and motor block necessary for all infra umbilical surgeries. Hyperbaric bupivacaine is the most commonly used intrathecal local anesthetic. 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 agonist opioid. 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.[8]

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 μg did not report any neurologic deficits with its use.

In our study design Group F received 0.5% of hyperbaric Bupvacaine 3ml with Fentanyl 25μg and Group D received 0.5% hyperbaric Bupivacaine 3ml with Dexmedetomidine 5 μ gms, injected intrathecally to the patients undergoing infraumbilical surgeries.

The following parameters were observed

- 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
- Post operative requirement of analgesia

***Kanaziet al*[19]**. 45 found that 3µg Dexmedetomidine or 30 µg 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 µgDexmedetomidine would be equipotent to 30-45 µg clonidine when used for supplementation of spinal bupivaciane.

Our study has shown that the addition of 5 µgDexmedetomidine 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 (3µg) 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 lack of sedation.

***Al-Ghanem et al*[21]**47 had studied the effect of addition of 5 µgDexmedetomidine or 25 µg Fentanyl intrathecal to10 mg isobaric bupivacaine in vaginal hysterectomy and concluded that 5 µgDexmedetomidine 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 al*[20]**46 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, ReetuVerma, JaishriBogra et al,*[23]** used Dexmedetomidine as an intrathecal adjuvant for post operative analgesia and found that the addition of 5 µgDexmedetomidine to ropivacaineintrathecally 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, ReetuVerma, JaishriBogra et al*[24]**, 50 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 , hemodynamic 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 ***Talke et al*[26]** and ***MaroofM et al*[27]**53 . We too did not find any incidence of shivering.

V. Conclusion

Addition of 5 µgDexmedetomidine 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 µgDexmedetomidine 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 stable conditions, minimal side effects, and excellent quality of postoperative analgesia.

To summarize, Dexmedetomidine has higher efficacy with Intrathecal bupivacaine with prolonged duration of sensory and motor blockade with decreased incidence of side effects , better haemodynamic stability and intraoperative sedation and also analgesic sparing effect in the post operative period when compared to Fentanyl

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

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