e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(11); 128-140

Original Research Article

A Comparative Study of Intrathecal Dexmedetomidine and Fentanyl as Adjuvants to Bupivacaine in Lower Abdominal, Perineal and Lower Limb Surgeries

Jayanta Padun[1], Barnita Basumatary[2], Arnav Das[3], Dibyajyoti Sonowal[4]

[1]Associate Professor, Dept. of Anaesthesiology, Jorhat Medical College and Hospital, Jorhat, Assam
[2]Assistant Professor, Dept. of Anaesthesiology, Jorhat Medical College and Hospital, Jorhat, Assam
[3]Assistant Professor, Dept. of Anaesthesiology, Jorhat Medical College and Hospital, Jorhat, Assam
[4]Post Graduate Student, Dept. of Anaesthesiology, Jorhat Medical College and Hospital, Jorhat, Assam

Received: 11-09-2023 / Revised: 12-10-2023 / Accepted: 23-11-2023
Corresponding Author: Arnav Das
Conflict of interest: Nil

Abstract

Introduction: Neuraxial administration of opioids along with local anaesthetics improves the quality of intraoperative analgesia and also provide postoperative pain relief for longer duration. Fentanyl in various doses(10, 20, 30, 40 micrograms) when added to intrathecal bupivacaine significantly reduces somatic and visceral pain and prolongs the time of regression of sensory block. Dexmedetomidine has been used for premedication and as adjunct to general anaesthesia. It reduces opioid and inhalational anaesthetics requirements. Intrathecal α_2-receptor agonists are found to have anti nociceptive action for both somatic and visceral pain.

Aims and Objectives: To compare the subarachnoid block characteristics, quality of analgesia, sedation, haemodynamic properties, sedation and any any adverse effects between dexmedetomidine and fentanyl as adjuvant with intrathecal bupivacaine

Materials and Methods: Total 120 patients were randomly allocated in two groups.

Group d (n=60) = received 5 micrograms (0.5ml) dexmedetomidine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally. Group f (n=60) = received 25 micrograms (0.5ml) of fentanyl with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally. Onset of analgesia, quality of motor block, haemodynamic properties, any adverse side effects were noted,

Conclusions: In conclusion , dexmedetomidine (5 µg) seems to be a better alternative to fentanyl (25 µg) as additive to intrathecal hyperbaric 0.5% bupivacaine (15 mg), since it produces more prolonged sensory and motor block with similar kind of haemodynamic stability , better postoperative analgesic and sedation and is assaociated with lesser adverse effects.

Keywords: Dexmedetomidine, Fentanyl, Intrathecal.

Introduction

Spinal anaesthesia is the most commonly used technique for lower abdominal and lower limb surgeries as it is very economical and easy to administer. Spinal block is still the first choice because of its rapid onset, superior blockade, low risk of infection as from catheter in situ, less failure rates and cost effectiveness, but has the drawbacks of shorter duration of block and lack of postoperative analgesia.

Neuraxial administration of opioids along with local anaesthetics improves the quality of intraoperative analgesia and also provide postoperative pain relief for longer duration. [1,2] Fentanyl in various doses(10, 20, 30, 40 micrograms) when added to intrathecal bupivacaine significantly reduces somatic and visceral pain and prolongs the time of regression of sensory block. [3] But often intrathecal fentanyl produces nausea, vomiting, pruritis and urinary retention in non-catheterized patients which are uncomfortable. [3]

Dexmedetomidine has been approved by the Food and Drug Administration(FDA) as a short term sedative for mechanically ventilated intensive care unit(ICU) patients. It has been used for premedication and as adjunct to general anaesthesia. It reduces opioid and inhalational anaesthetics requirements. [4]

Considering all these observations the present study was designed to compare the effects of adding dexmedetomidine and fentanyl to 0.5% hyperbaric bupivacaine on subarachnoid block characteristics, intraoperative and postoperative analgesia and sedation in patients undergoing lower abdominal, perineal and lower limb surgeries. We also assessed

the haemodynamic response and the adverse effects in both the groups.

Aims and Objectives

1. To compare the subarachnoid block characteristics between dexmedetomidine and fentanyl as adjuvant with intrathecal bupivacaine.
2. To compare the quality of intraoperative and postoperative analgesia and sedation between dexmedetomidine and fentanyl as adjuvant with intrathecalbupivacaine.
3. To compare the haemodynamic response following subarachnoid block between dexmedetomidine and fentanyl as adjuvant withi ntrathecal bupivacaine.
4. To compare the adverse effects between dexmedetomidine and fentanyl as adjuvant with intrathecal bupivacaine.

Materials and Methods

After approval of the institutional ethical committee and after obtaining informed written consent from the patient, study was conducted in Jorhat Medical College & Hospital, Jorhat on 120 patients undergoing elective lower abdominal, perineal and lower limb surgeries.

Sample Size

Total patients = 120

They were randomly allocated in two groups.

Group d (n=60) = received 5 micrograms (0.5ml) dexmedetomidine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally.

Group f (n=60) = received 25 micrograms (0.5ml) of fentanyl with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally.

INCLUSION CRITERIA	EXCLUSION CRITERIA
• Patients in the age group 20 - 50 yrs • ASA grade I and II physi-cal status patients • Elective lower abdominal , perineal and lower limb surgeries • Patient approval	• Patients belonging to ASA III and IV physical status • Patients with uncontrolled or labile hypertension • Known diabetes mellitus patients • Patients with psychiatric diseases • Patients with chronic low back pain • Patients with hepatic and renal impairment. • Anticipated difficult tracheal intubation • Patients on alpha and beta blockers treatment • Patients with known allergy to any local anaesthetic or opioid • Patients where subarachnoid block was contraindicated like bleeding tendencies , local infection and patient refusal.

Study Design

It was a randomized double blinded prospective study.

Study Tools

IV canula, transfusion set, IV fluids, hyperbaric bupivacaine 0.5%, dexmedetomidine, fentanyl citrate, boyle's machine, spinal needle, glass syringe, emergency drugs will be kept ready, multichannel monitor- NIBP, HR,SpO_2, continuous ECG, pulse-oximeter, hypodermic needle, Bromage scale, visual analogue scale, Filos' Numerical scale for assessing sedation.

Anaesthesia Method:

- Boyle's anaesthesia machine was checked.
- Appropriate size endotracheal tubes, working laryngoscope with medium and large size blades, stylet and working suction apparatus were kept ready before the procedure.
- Emergency drug tray consisting of atropine, adrenaline, mephentermine, ephedrine and dopamine were kept ready.
- 120 patients were selected. Standard monitoring devices were connected before starting the procedure and an IV canula 18 Gauge were inserted.

All patients will be premedicated with-

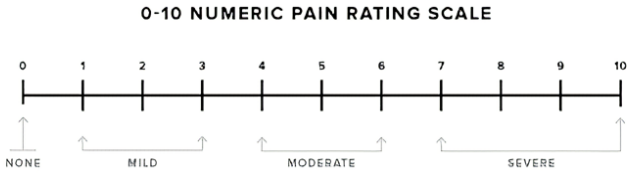
-Inj Ranitidine 1 mg / kg body wt (morning 6 AM) iv

-InjOndensatron 0.1 mg / kg body wt (morning 6 AM)iv

-Tab Alprazolam 0.5 night before surgery

- Patients were instructed about Visual Analogue Scale (VAS) and also a scale of 10 cm length with 0 on the scale corresponding to

"NO PAIN " and 10 "MAXIMUM INTOLERABLE PAIN EXPERIENCED



- Before the start of the procedure patients pulse rate, blood pressure, respiratory rate and saturation of oxygen were recorded. All the patients were preloaded with 500ml of Ringer's Lactate prior to spinal anaesthesia.
- Under all aseptic precaution lumbar puncture were performed with 25 Gauge Quincke's needle in the L3-4 space through midline approach. Group D received hyperbaric bupivacaine (0.5%) 15mg(3ml) and 5 µg (0.5ml) dexmedetomidine in 3.5ml. Group F received hyperbaric bupivacaine(0.5%) 15 mg(3ml) and 25 µg (0.5ml) fentanyl in 3.5ml. Dexmedetodine is supplied as 100 µg/ml concentration, therefore it was diluted in preservative free normal saline so that each ml of the drug contained 10 µg of dexmedetomidine. Immediately after intrathecal injection the patients were made supine.
- All patients were given oxygen by face mask at 2L/min.
- All patients were assessed for-

-Time for onset of sensory analgesia at T_{10} level.
-Highest level of sensory analgesia.
-Duration of grade 3 motor block according to Bromage scale.
-Duration of analgesia (time from sensory blockade to first rescue parenteral analgesic).
-Regression time for sensory and motor block in Post Anaesthetic Care Unit (PACU)/ Post Operative Care Unit (POCU).
-Heart rate, systolic and diastolic pressure were recorded at 10 minutes interval intraoperatively.
-In the Post Anaesthetic Care Unit (PACU)/ Post Operative Care Unit(POCU) vitals signs were recorded every 15 minutes for 6 hours.
-The sensory block level was assessed by pin prick along mid clavicular line bilaterally. The motor block were assessed according to the modified Bromage scale.
-Any complication or side effects like shivering, nausea-vomiting, hypotension, bradycardia, pruritis and urinary retention were recorded.

All durations were calculated considering the time of spinal injection as time zero.

- Assessment of pain intraoperatively was done by noting Visual Analogue Scale score hourly
- Post operative pain score (VAS) and sedation score (according to Filos' numerical scale) were recorded at 1 hr, 6 hrs, 12 hrs, 24 hrs.
- Rescue analgesia was given with IV tramadol on demand when VAS score > 4. Dose of 50mg as needed with maximum dose of 600mg/day.

Onset of Analgesia

This was the time taken to achieve the analgesia at T_{10} dermatome assessed by pin prick method in the mid clavicular line using 24 G needle

Maximum Level of Analgesia

This was taken from intrathecal injection to the highest level of sensory block as assessed by pin prick method. The time taken to achieve maximum level was noted.
Quality of motor blockade
The motor blockade was assessed using Bromage scale -
0 –No paralysis
1 – Inability to raise extended leg against gravity but able to flex knee
2 – inability to flex knee but able to flex ankle
3– unable to flex ankle but able to wriggle toes
Filos' numerical scale:
Scale 1 = awake and nervous
Scale 2 = awake and relaxed
Scale 3 = sleepy but easy to awake
Scale 4 = sleepy but hard to awake

Statistical Analysis:

Statistical analysis was done with appropriate tests. Student-t test, Chi-square test, Fischer's exact test, ANOVA and other relevant tests were used accordingly for analyzing the data. P value < 0.05 was considered to be significant.

Tables and Observations

Table 1 : Comparison of subarachnoid block charcteristics between two groups

Variables	Group D	Group F	P value
Time to reach T10 sensory block level	5.363 ± 0.5672 min	5.445 ± 0.539 min	0.4205
Highest level of sensory block	T_4 (T_4-T_7)	T_6 (T_4-T_7)	0.382
Time to reach highest level of sensory block	18.650 ± 1.006 min	18.798 ± 1.084 min	0.4388
Time to reach Bromage-3 motor block	12.843± 0.8137 min	12.890 ± 0.7972 min	0.7516
Regression time to S1 dermatome level	291.15 ±14.348 min	170.12 ± 14.159 min	< 0.0001
Regression time to reach Bromage-0	233.42 ± 10.755 min	141.62 ± 14.317 min	< 0.0001

On comparing the spinal block characteristics among the two groups it was noticed that there was no significant difference in the onset of sensory and motor block (Group D =5.363 ± 0.5672 min, Group F=5.445 ± 0.539 min ; P value =0.4205), highest block level, the time to reach the highest level of sensory block (Group D = 18.650 ± 1.006 min , Group F = 18.798 ± 1.084 min ; P value =0.4388), time to reach Bromage – 3 motor block (Group D =12.843 ± 0.8137 min , Group F = 12.890 ± 0.7972 min ; P value = 0.7516), but the regression time of both sensory and motor block were extremely significantly prolonged in Group D. The mean regression time to S1 dermatome level was significantly longer in Group D (291.15 ±14.348 min)than in Group F (170.12 ± 14.159 min) ; P value = < 0.0001, also the mean regression time to reach Bromage0 in Group D (233.42 ± 10.755 min) was extremely prolonged than that of Group F (141.62 ± 14.317 min) ; P value =< 0.0001.

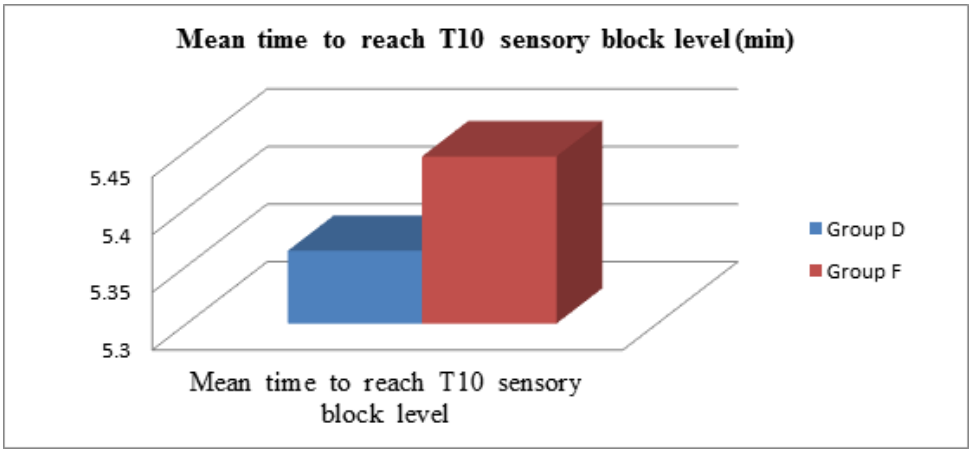


Figure : Comparison of the mean time to reach T10 sensory block level

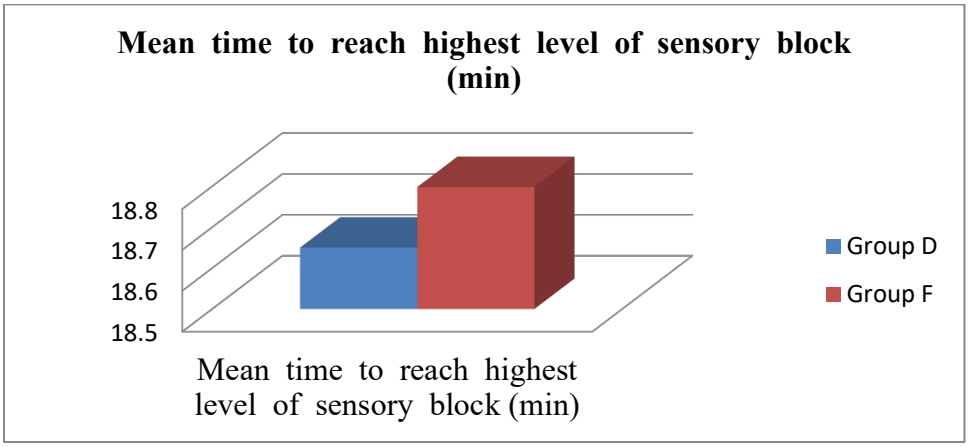


Figure : Comparison of the mean time to reach highest level of sensory Block

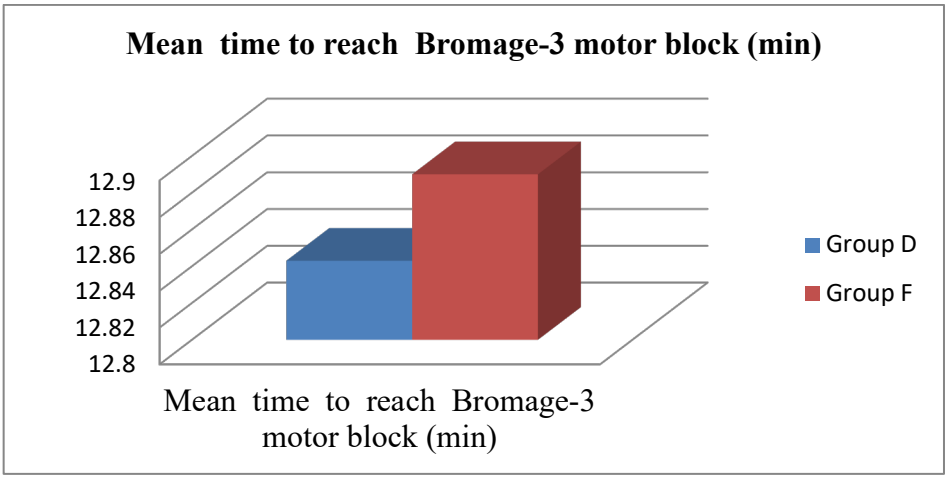


Figure : Comparison of the mean time to reach Bromage-3 motor block

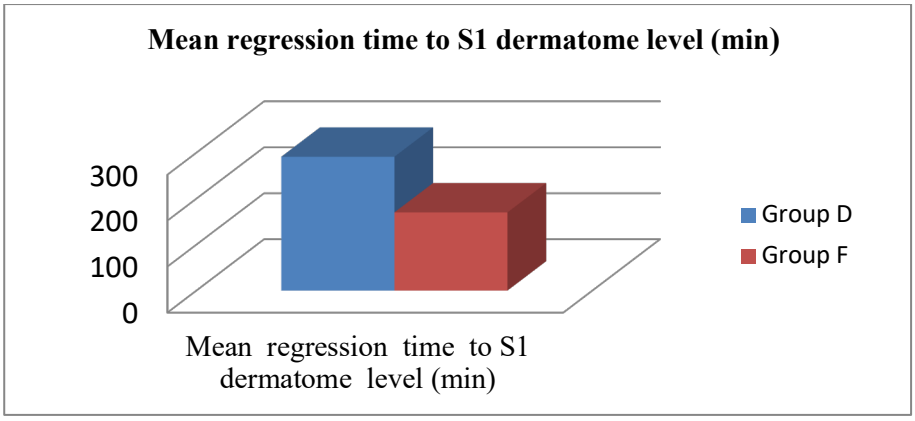


Figure : Comparison of the mean regression time to S1 dermatome level

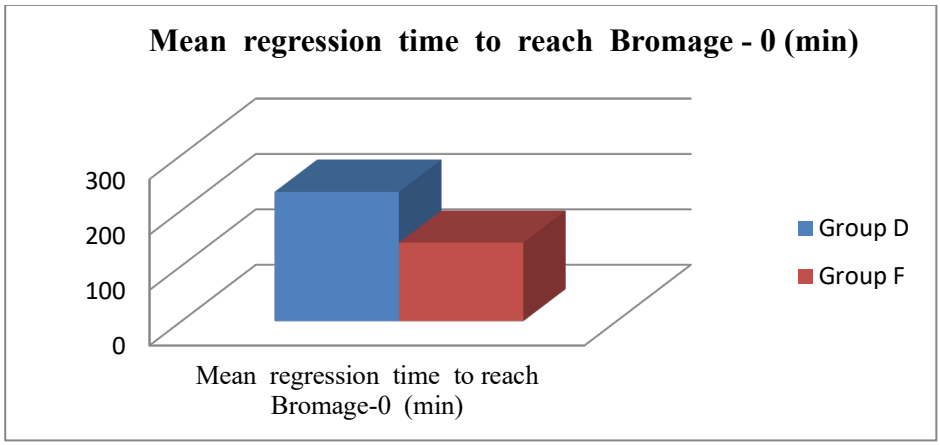


Figure: Comparison of the mean regression time to reach Bromage-0

Table 3: Comparison of intraoperative analgesia

VAS Score	Groups	Mean	SD	P Value
1st hour	Group D	0.00	0.00	
	Group F	0.00	0.00	
2nd hour	Group D	0.08333	0.2787	0.3269
	Group F	0.1500	0.4444	
3rd hour	Group D	0.00	0.00	
	Group F	0.00	0.00	

No patients required additional analgesics intraoperatively and the mean intraoperative VAS score was comparable in the two groups.

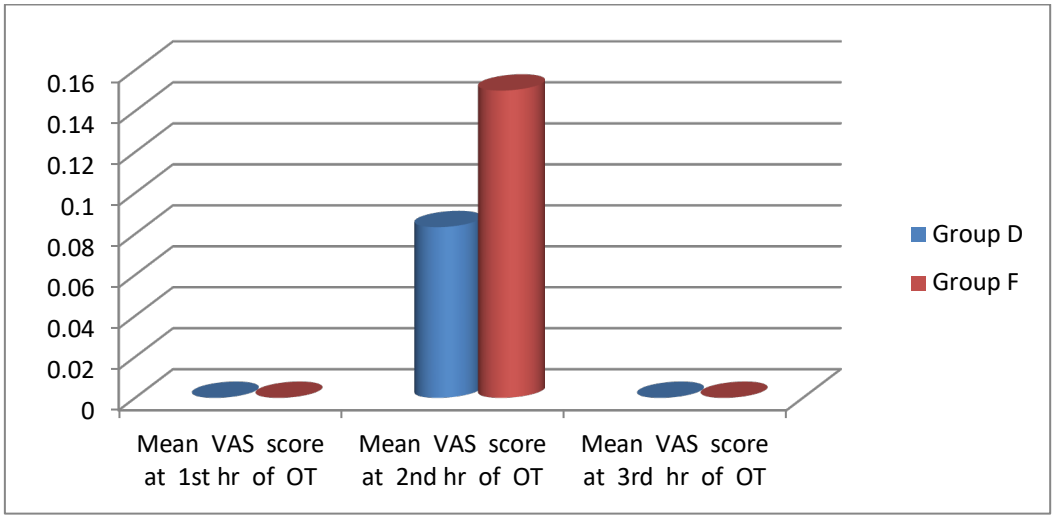


Figure: Comparison of mean intraoperative VAS score

Table 4: Comparison of intraoperative sedation

Filo's sedation scale score	Groups	Mean	SD	P value
1st hour	Group D	2.933	0.2515	< 0.0001
	Group F	2.017	0.5365	
2nd hour	Group D	2.932	0.2536	< 0.0001
	Group F	1.867	0.3428	
3rd hour	Group D	2.83	0.41	0.0009
	Group F	1.86	0.38	

Most of the patients in Group F were awake and relaxed (sedation scale = 2) intraoperatively, on the other hand the patients in Group D were mostly sleepy but easily arousable (sedation scale = 3).

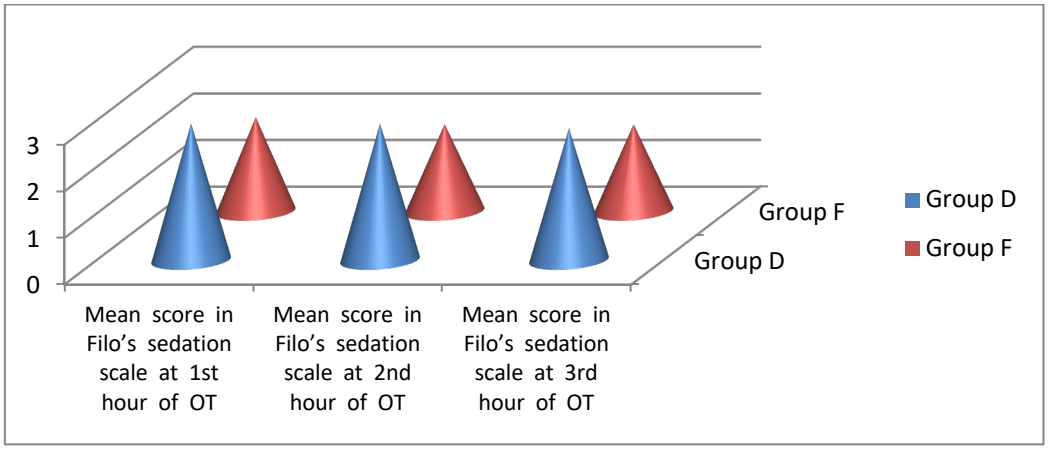


Figure: Comparison of mean intraoperative Filo's sedation scale score

Table 5: Comparison of postoperative analgesia

VAS score	Groups	Mean	SD	P Value
1st hour	D	0.05000	0.2198	0.3547
	F	0.1000	0.3542	
6th hour	D	2.087	0.1937	0.4750
	F	2.113	0.2061	
12th hour	D	2.978	0.3369	0.3021
	F	3.049	0.4051	
24th hour	D	3.087	0.4365	0.6190
	F	3.049	0.4051	

The mean postoperative VAS scores at 1st, 6th, 12th and 24th were comparable in the two groups.

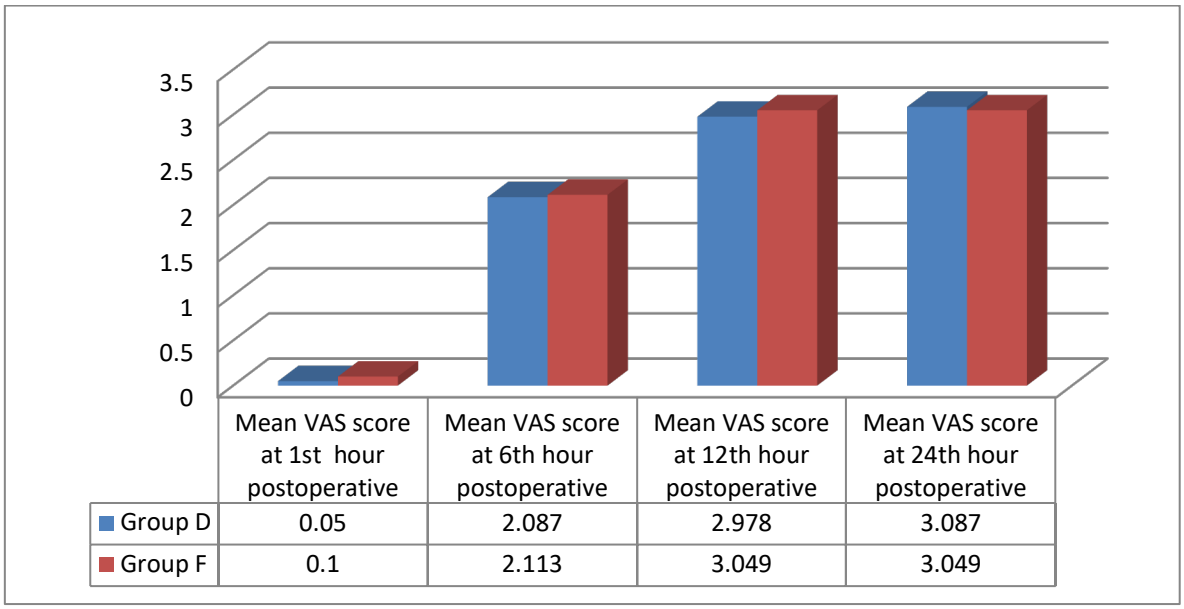


Figure: Comparison of mean postoperative VAS score

Table 6 :Comparison of the time for rescue analgesia

Groups	Time for rescue analgesia (min)		
	Mean	SD	P value
D	182.00	14.721	
F	81.083	8.800	< 0.0001

The mean time after operation, when the patient demanded rescue analgesic was significantly longer in Group D (182 min) than that in Group F (81 min) ; P value = < 0.0001.

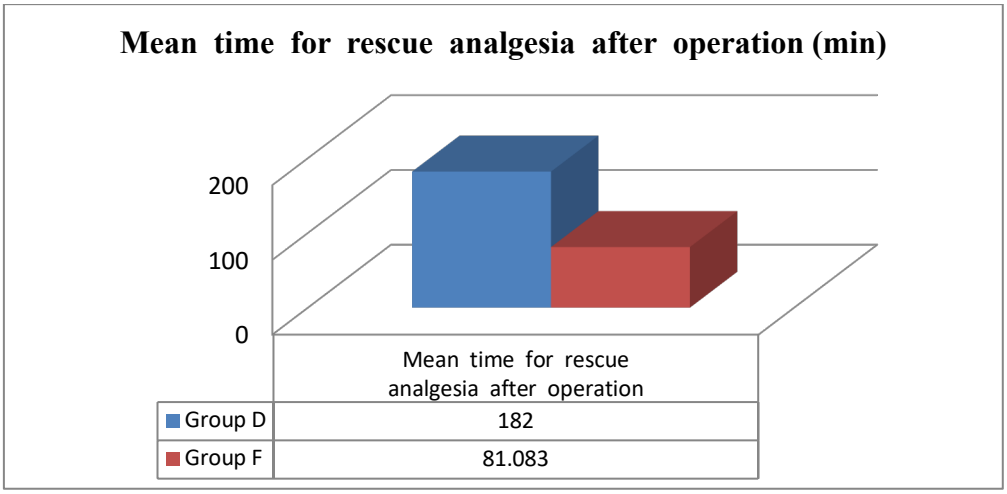


Figure : Comparison of the mean time for rescue analgesia

Table 7: Comparison of postoperative sedation

Filo's sedation scale score	Groups	Mean	SD	P value
1st hour	Group D	2.983	0.1291	< 0.0001
	Group F	2.033	0.4103	
6th hour	Group D	2.850	0.3601	< 0.0001
	Group F	1.850	0.3601	
12th hour	Group D	1.850	0.3601	0.1181
	Group F	1.733	0.4459	
24th hour	Group D	1.867	0.3428	0.1599
	Group F	1.767	0.4265	

The mean postoperative sedation scale score was significantly higher in group D than that in group F at 1st hour (Group D = 2.983 ± 0.1291 , Group F =2.033 ± 0.4103, P value =< 0.0001) and6th hour (Group D = 2.850±0.3601 , Group F = 1.850 ± 0.3601, P value = < 0.0001)

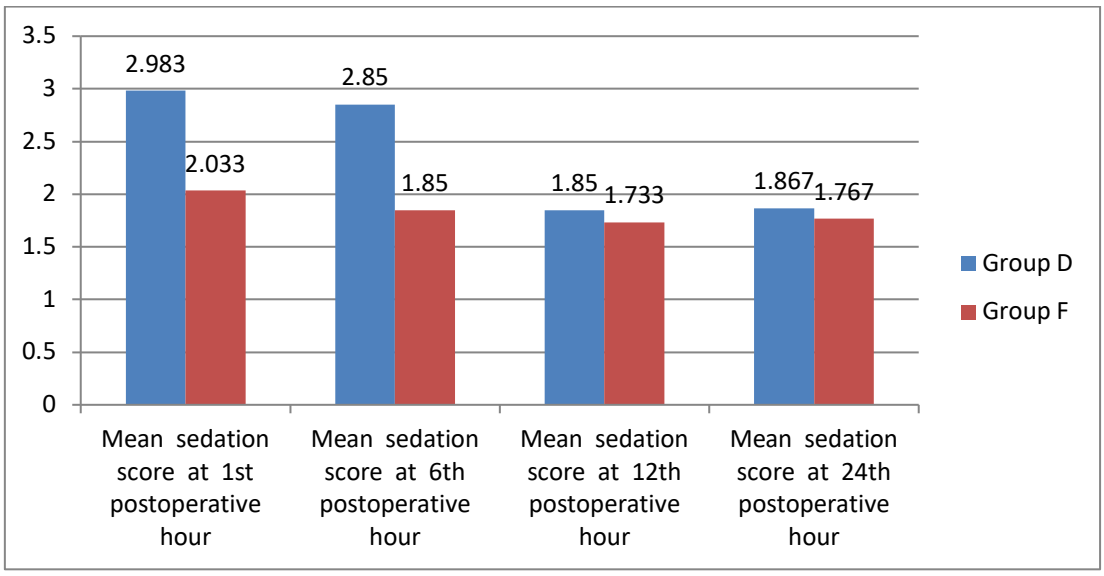


Figure : Comparison of mean postoperative Filo's sedation scale score

Table 8: Comparison of intraoperative heart rate (beats / minute) between the groups

Time	Groups	Mean	SD	P value
Baseline	D	75.550	5.850	0.6815
	F	75.133	5.229	
10 min	D	75.583	5.823	0.6568
	F	75.133	5.229	
20 min	D	74.750	5.914	0.6791
	F	75.183	5.525	
30 min	D	74.683	5.841	0.7650
	F	74.983	5.101	
40 min	D	75.517	5.864	0.8289
	F	75.300	5.067	
50 min	D	75.433	5.812	0.6649
	F	75.000	5.096	
1 hour	D	75.550	5.850	0.5839
	F	75.000	5.096	
1 hour 10 min	D	75.550	5.850	0.7441
	F	75.217	5.295	
1 hour 20 min	D	74.750	5.914	0.7108
	F	75.133	5.369	
1 hour 30 min	D	75.550	5.879	0.8080
	F	75.300	5.356	
1 hour 40 min	D	75.350	5.825	0.6437
	F	74.883	5.182	
1 hour 50 min	D	74.76	5.47	0.6304
	F	74.16	5.26	
2 hour	D	76.71	6.72	0.1993
	F	74.00	5.48	
2 hour 10 min	D	74.33	5.99	0.9884
	F	74.29	5.59	

The mean value of heart rate changes per minute recorded in group D and group F were almost similar and statistically not significant.

Table 9: Comparison of intraoperative systolic blood pressure(mm of Hg) between the groups

Time	Groups	Mean	SD	P value
Baseline	D	122.63	5.099	0.6969
	F	123.00	5.188	
10 min	D	122.63	5.099	0.7797
	F	122.90	5.319	
20 min	D	122.60	5.043	0.6693
	F	123.00	5.188	
30 min	D	121.72	4.540	0.5338
	F	122.25	4.817	
40 min	D	122.47	4.990	0.6462
	F	122.90	5.319	
50 min	D	122.50	4.925	0.5892
	F	123.00	5.188	
1 hour	D	122.37	4.812	0.4895
	F	123.00	5.188	
Time	Groups	Mean	SD	P value
1 hour 10 min	D	122.27	4.683	0.4951
	F	122.87	4.918	
1 hour 20 min	D	122.27	4.683	0.4815
	F	122.88	4.882	
1 hour 30 min	D	122.57	5.027	0.7249
	F	122.90	5.319	
1 hour 40 min	D	122.60	5.043	0.6684
	F	123.00	5.162	
1 hour 50 min	D	123.32	3.54	0.7509
	F	123.00	5.11	
2 hour	D	122.71	5.29	0.8686
	F	123.00	5.14	
2 hour 10 min	D	122.67	7.55	0.4113
	F	119.71	4.82	

Applying the independent samples t – test between the mean of systolic blood pressures in each group at various time points of operation, we observed that there was no significant statistical difference between the groups.

Table 10: Comparison of intraoperative diastolic blood pressure (mm of Hg) between the groups

Time	Groups	Mean	SD	P value
Baseline	D	76.000	4.658	0.4626
	F	75.400	4.251	
10 min	D	75.933	4.701	0.4289
	F	75.283	4.259	
20 min	D	75.917	4.760	0.6453
	F	75.517	4.735	
30 min	D	75.833	4.727	0.6438
	F	75.450	4.323	
40 min	D	75.167	5.136	0.4890
	F	74.567	4.296	
50 min	D	76.050	4.873	0.5977
	F	75.583	4.788	
1 hour	D	75.167	5.136	0.5173
	F	74.600	4.393	
1 hour 10 min	D	76.000	4.658	0.4911
	F	75.433	4.323	
1 hour 20 min	D	75.167	5.136	0.4917
	F	74.567	4.362	
1 hour 30 min	D	75.917	4.724	0.7309
	F	75.617	4.809	
1 hour 40 min	D	76.000	4.815	0.6634
	F	75.617	4.809	
1 hour 50 min	D	75.05	5.34	0.6971
	F	74.61	4.59	
2 hour	D	75.76	4.94	0.5688
	F	74.78	5.19	
2 hour 10 min	D	77.00	77.43	0.8991
	F	6.16	5.74	

Applying the independent samples t – test between the mean of diastolic blood pressures in each group at various time points of operation, we observed that there was no significant statistical difference between the groups.

Table 11: Comparison of the incidences of adverse effects between the groups

Adverse effects	Groups	Incidence	P value
Nausea	D	2 (3.33%)	0.0114
	F	9 (15%)	
Vomiting	D	0 (0%)	0.0195
	F	5 (8.33%)	
Pruritis	D	1 (1.66%)	0.1205
	F	5 (8.33%)	
Bradycardia	D	4 (6.66%)	0.5536
	F	3 (5%)	
Hypotension	D	6 (10%)	0.6404
	F	5 (8.33%)	
Shivering	D	1 (1.66%)	0.2361
	F	3 (5%)	
Urinary retention in non catheterized patients	D	0 (0%)	0.0049
	F	7 (11.66%)	

Applying the Pearson chi-square test between the incidences of various adverse effects in each group, we calculated the P value. We found that the incidence of nausea and vomiting was significantly higher in group F (15% and 8.33% respectively) in comparison with group D (3.33% and 0% respectively) , P value = 0.0114for nausea and 0.0195 for vomiting ; both are < 0.05. Incidence of bradycardia and hypotension was higher in group D (6.66% and 10% respectively) compared with that of group F (5% and 8.33% respectively), but was statistically insignificant ; P value = 0.5536 and 0.6404 for bradycardia and hypotension respectively. Incidence of pruritis after intrathecal administration of fentanyl was 8.33% in this study compared with 1.66% in case of intrathecal

dexmedetomidine ; P value = 0.1205 ; which is statistically insignificant. In the present study the incidence of urinary retention was significantly higher in fentanyl group (11.66%) in comparison with dexmedetomidine group (0%); P value = 0.0049. There was no statistical difference between the incidences of shivering in both groups, P value = 0.236

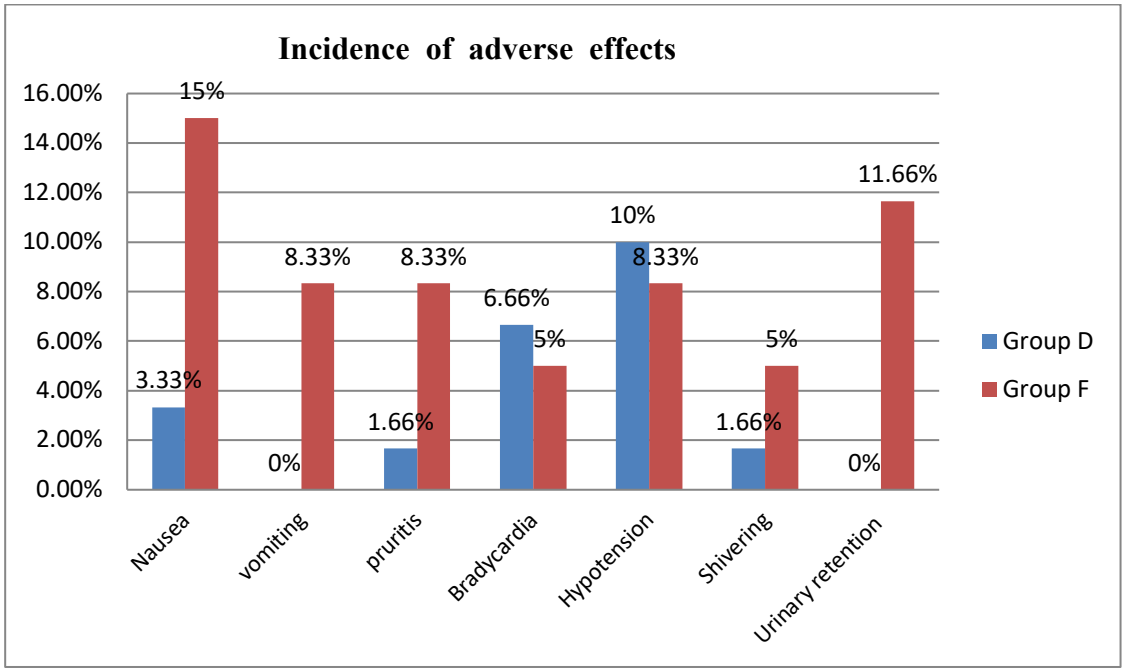


Figure : Comparison of the incidences of adverse effects between the groups

Discussion

The **demographic profile** such as mean age , weight , height were comparable between the two groups. We had considered only elective lower abdominal , perineal and lower limb surgeries in our study .

Sensory Characteristics:

The duration of onset of sensory block , i.e the time taken from the administration of the drug to the loss of pin prick sensation at the T_{10}dermatomal level bilaterally.

In the present study the mean time of onset of analgesia at T_{10} level in Group D was 5.363± 0.5672 minutes and in group F the corresponding value was 5.445±0.539 minutes. The difference in the mean time between the two groups was not statistically significant.

Ibrahim F. A. Khalifa [6] in 2009, conducted a comparative study of adding intrathecal dexmedetomidine versus sufentanil to heavy bupivacaine for postoperative analgesia in 50 patients undergoing inguinal hernia repair. He concluded that intrathecal 5 mcg dexmedetomidine produces more prolonged sensory and motor block in comparison with 5 mcg sufentanil when added to 2 ml of 0.5% hyperbaric bupivacaine.

Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa [6] in their study in 2009,using intrathecal 10 mg isobaric bupivacaine plus 5 mcg dexmetedomidine (group D) and 10 mg isobaric bupivacaine plus 25 mcg fentanyl(Group F) found no significant difference in the time of onset of sensory block to T10 level (7.5±7.4 min for Group D and 7.4±3.3 min for Group F) .

Regarding the **highest level of sensory block**, in our study group D majority of the patients attained highest sensory block of T_4 as compared to T_6 in patients belonging to group F. The difference between the two groups was statistically insignificant.

In the study conducted by *Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa*[6]in 2009, the peak sensory level was T6 (T4-T9) in dexmedetomidine group and T6 (T3-T8) in fentanyl group, which was also statistically insignificant.

Another study conducted by *Rajni Gupta, Reetu Verma, Jaishri Bogra et al* [7] in 2011, found no difference in the highest level of block achieved, T5 and T6 for dexmedetomidine and fentanyl group respectively.

The mean **time to achieve highest level of sensory block** in Group D was 18.650 ± 1.006 minutes and 18.798 ± 1..084 minutes in Group F , which was statistically not significant .

Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa et al [7] in their study, observed that the time to reach maximal sensory block was 19.34

± 2.87 min for dexmedetomidine group and 18.39 ± 2.46 for fentanyl group which was statistically insignificant (p value = 0.126).

In the present study , **time for sensory regression to S_1** , in Group D i.e Dexmedetomidine group , was 291.15± 14.348 minutes while in the Fentanyl group , i.e Group F, it was 170.12± 14.159 minutes. Difference between the two durations was extremely significant(p <0.0001).

In the study conducted by*Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa et al* [6] (2009), the mean time to reach S1 segment was significantly longer in dexmedetomidine group (274.8±73.4minutes)than in fentanyl group (179.5 ± 47.4 minutes), an observation that also goes with our study.

Rajni Gupta, Reetu Verma, Jaishri Bogra et al [7] (2011), also observed significant difference between the groups (dexmedetomidine group being longer) in the mean time for sensory regression to S1 from highest sensory level.

Motor Blockade Characteristics:

In the present study the **time of onset of grade III motor blockade** was not statistically significant(p > 0.05)in both groups. The mean time of onset of grade III motor blockade in Group D i.e Dexmedetomidine group was 12. 843± 0.8137 minutes while in the Fentanyl group i.e group F it was12.890± 0.7972 minutes.

In the present study, the mean regression time to reach Bromage-0 in Group D was 233.42±10.75 minutes while in the Group F the corresponding value was 141.62+ 14.317 minutes and the difference between the two timings was extremely significant with p < 0.0001.

The prolongation of motor effect might be caused by direct impairment of excitatory amino acid release from spinal interneurons. Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa et al [6] (2009), also found no difference in the onset of Bromage 3 motor block between the groups (14.4 ± 6.7 minutes for dexmedetomidine and 14.3 ± 5.7 minutes for fentanyl). In the same study the regression time to reach Bromage-0 in dexmedetomidine group (240 ± 64 minutes) was found significantly longer than the fentanyl group (155 ± 46 minutes).

Rajni Gupta, ReetuVerma, Jaishri Bogra et al [7] (2011), in their study observed no difference in the onset time to Bromage – 3 motor block (11.6 ±1.8 minutes in dexmedetomidine group and 11.2 ± 1.3 minutes in fentanyl group)but the regression of motor block to Bromage 0 was significantly slower with the addition of dexmedetomidine (421 ± 21 minutes and 149.3 ± 18.2 minutes in dexmedetomidine and fentanyl groups respectively)

Characteristic of Analgesia:

In our study, no patients required additional analgesics intra operatively and the mean intraoperative VAS score was similar in the two groups. Postoperative pain was assessed using a 10 cm Visual Analogue Scale (VAS) where '0'indicated 'No Pain' and '10' indicated 'worst imaginable pain'.The mean postoperative VAS scores at 1st, 6th, 12th and 24th hours were also comparable.

The duration of analgesia, defined as the time between the onset of block and time to first analgesic requirement was noted. Rescue analgesic was provided when VAS score was >3. The time to first rescue analgesic requirement in Group D was 182.00 ± 14.721 minutes whereas in Group F, this was81.083 ± 8.8 minutes. This difference was statistically significant (P < 0.0001).

In the study conducted by *Rajni Gupta, Reetu Verma, Jaishri Bogra et al*[7](2011),the time to rescue analgesic was significantly longer in dexmedetomidine group (251.7 ± 30.69 minutes).

Sedation Score

In our study, sedation was assessed using Filo,s sedation scale score. Most of the patients in group F were awake and relaxed (sedation scale = 2) intraoperatively, on the other hand the patients in group D were mostly sleepy but easily arousable (sedation scale = 3) . The mean postoperative sedation scale score was also significantly higher in group D than that in group F at 1 and 6 hours.

α-2 agonists produce sedative effect by acting on α-2-adrenergic receptors in locus ceruleus. The cause of sedation after intrathecal dexmedetomidine may be related to its systemic absorption and vascular redistribution to higher centers or cephalad migration in CSF.

Vieira AM, Schnaider TB, Brandao AC, Pereira FA, Costa ED, Fonseca CE[8](2004), evaluated the analgesia and sedation promoted by clonidine or dexmedetomidine associated to epidural ropivacaine in patients submitted to subcostal cholecystectomy and concluded that the addition of clonidine (150 mcg) or dexmedetomidine (2 mcg/ kg) to 20 ml of 0.75% ropivacaine induces analgesia and sedation at 2 and 6 hours after anaesthetic recovery and that clonidine promotes more prolonged analgesia.

In the study conducted by*Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa et al* [6](2009), the sedation score was between 0 and 1 in both groups which doesn't concur with our study.

Hala E A Eid, Mohamed A Shafie, HendYoussef[9](2011), studied the dose-related

prolongation of hyperbaric bupivacaine spinal anesthesia by dexmedetomidine. Forty eight adult patients scheduled for anterior cruciate ligament reconstruction were randomized to one of three groups. Each patient was given 3.5 ml spinal injectate that consisted of 3 ml 0.5% hyperbaric bupivacaine and 0.5 ml containing either 10 mcg dexmedetomidine(Group D1), 15 mcg dexmedetomidine (D2) or normal saline (Group B). they observed that the sedation scores were significantly higher with 15 mcg dose.

Rajni Gupta, ReetuVerma, JaishriBogra et al [7] (2011), in their study observed that the mean sedation score was more in dexmedetomidine group patients (3.8 ± 0.5 minutes) as compared to fentanyl group patients (2.2 ± 0.53 minutes), which was statistically significant.

Haemodynamic Parameters:

Hypotension is considered as fall in systolic blood pressure of more than 20 % of the baseline systolic pressure or systolic pressure < 90 mm Hg. Heart rate less than 60 bpm is considered bradycardia. Hypotension was due to the decrease in the sympathetic efferent activity after spinal anaesthesia and is said to be dose related to bupivacaine Hypotension was observed in 10 % patients in group D and in 8.33% patients in group F and these patients were treated with intravenous fluid increments and injection mephentermine IV.The mean values of heart rate changes per minute recorded in Group D and Group F were almost similar. This was statistically not significant.

The mean value of mean arterial blood pressure changes in mmHg between Group D and Group F were almost similar. This was statistically not significant.Similar results were obtained in the studies done by *Khalifa F.A. Ibrahim* [5] who conducted a study to evaluate the effect of adding dexmedetomidine or sufentanyl to intrathecal hyperbaric bupivacaine for post operative analgesia in patients undergoing inguinal hernia repair.

Subhi M. Al-Ghanem, Islam M. Massad, Mahmoud M. Al-Mustafa et al **[5],** in their study observed mild to moderate hypotension in both dexmedetomidine and fentanyl groups and was statistically insignificant

In the study conducted by *Rajni Gupta, Reetu Verma, Jaishri Bogra et al* [7] (2011), there was comparable fall in systolic and diastolic blood pressure with hypotension in 10% of the patients of the dexmedetomidine group and 6.66% in the fentanyl group.

The most significant side – effects reported about the use of intrathecal α-2 adrenoreceptor agonists are bradycardia and hypotension. In the present study , these side effects were not significant probably because we used small dose of intrathecal dexmedetomidine which was also confirmed by *Kanazi* [10] in his study.

Hypotension occurred generally at 25-30 minutes after spinal injection.

Bradycardiawas seen in 6.66% in Group D, i.e. bupivacaine with dexmedetomidine and 5% in Group F, i.e. bupivacaine with fentanyl group. These patients responded to injection atropine 0.4 mg IV which was not significant statistically. Similar results were obtained by *Rajni Gupta, Reetu Verma, Jaishri Bogra et al* [7](2011).

Nausea , vomiting was significantly higher in group F (15% and 8.33% respectively) as compared to group D (3.33% and 0% respectively), p value = 0.0114 for nausea and p = 0.0195 for vomiting ; both being < 0.05.

Fentanyl stimulates the chemoreceptor trigger zone in the area postrema of the medulla, possibly through delta receptors and thereby leads to nausea and vomiting.

Pruritis after intrathecal administration of fentanyl is reported to be 40%-50%, but it was only 8.33% in the present study and not significantly higher than that of group D (1.66%). This can be explained by the fact that pruritis is a benign subjective symptom ,so it is often under reported and usually need no treatment. Intrathecal fentanyl inducing itching is suggested to be mediated by μ- receptor. Naloxone reverses opioid induced itching and this supports a receptor mediated central mechanism for pruritis.

Intrathecal fentanyl causes dose dependent suppression of detrusor contractility and decreases sensation of urge which lead to **urinary retention** in non-catheterized patients. Mean time of recovery of lower urinary tract function is 5 hours after administration of 25 micrograms of fentanyl. In our study the incidence of urinary retention was significantly higher in fentanyl group (11.66%) in comparison to dexmedetomidine group (0%); p value = 0.0049. Similar fact was also supported *Seewal R, Shende D, Kashyap L, Mohan V*[3] who studied the effect of addition of various doses of fentanyl intrathecally to 0.5% hyperbaric bupivacaine on perioperative analgesia and subarachnoid-block characteristics in lower abdominal surgeries, and concluded that fentanyl in various doses (10,20, 30, 40 micrograms) when added to intrathecal bupivacaine significantly reduces somatic and visceral pain and prolongs the time of regression of sensory block, but sometimes intrathecal fentanyl produces nausea, vomiting, pruritis and urinary retention in non catheterized patients, especially in higher doses.

Incidence of **shivering** was similar in both the groups. Both fentanyl and dexmedetomidine attenuates shivering when used intravenously. The

anti shivering effect of fentanyl is primarily related to reduction in shivering threshold and seems to be mediated by its activity on k- receptor. On the other hand intravenous dexmedetomidine reduces both vasoconstriction and shivering threshold.

None of the patients experienced any **neurological complication , post dural puncture headache or radicular irritation** in the postoperative period.

Conclusion

In conclusion , dexmedetomidine (5 µg) seems to be a better alternative to fentanyl (25 µg) as additive to intrathecal hyperbaric 0.5% bupivacaine (15 mg), since it produces more prolonged sensory and motor block with similar kind of haemodynamic stability , better postoperative analgesic and sedation and is assaociated with lesser adverse effects. This kind of block may be more suitable for lower abdominal surgeries of longer duration. Intrathecal dose of dexmedetomidine used in the present study needs further clinical studies to prove its efficacy and safety and to be considered as the suitable dose of dexmedetomidine for supplementation of spinal local anaesthetics.

Funding: None

Bibliography

1. Catherine O Hunt, Stephen J Naulty, Angela M Bader, Martha A Hauch, Jasmine V Vartikar, Sanjay Datta, et al. Perioperative analgesia with subarachnoid fentanyl-bupivacaine for caesarean delivery.Anaesthesiology 1989;71:535-540.
2. Abouleish E, Rawal N, Shaw J, Loreny T, Rashad MN. Intrathecal morphine 0.2 mg or bupivacaine 0.125% or their combination; , effects on parturients. Anaesthesiology 1991;74: 711-16.
3. Seewal R, Shende D, Kashyap L, Mohan V, et al: Effect of addition of various doses of fentanyl intrathecally to 0.5% hyperbaric bupivacaine on perioperative analgesia and subarachnoid block characteristics in lower abdominal surgery.A dose response study. Reg Anesth Pain Med 2007 Jan-Feb;32(1):20-6.
4. Martin E, Ramsay G, Mantz J, Sum-Ping ST. The role of the alpha2-adrenoreceptor agonist dexmedetomidine in post-surgical sedation in the intensive care unit. J Intensive Care Med 2003;18:29-34
5. Ibrahim F. A. Khalifa. A comparative study of adding intrathecal dexmedetomidine versus sufentanil to heavy bupivacaine for postoperative analgesia in patients undergoing inguinal hernia repair. Sept. 2009;26(3):207
6. Al-Ghanem SM, Massad IM, AL-Mustafa MM, Al-Zaben KR, Qudaisat IY, Qatawneh AM and Abu-Ali HM. Effect of adding dexmedetomidine versus fentanyl to intrathecal bupivacaine on spinal block characteristics in gynaecological procedures. A double blind control study.Am J Appl Sci 2009;6:882-7.
7. 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 Anaesth Clin Pharmacol 2011;27:339-43.
8. Vieira AM, Schnaider TB, Brandão AC , Pereira FA, Costa ED, Fonseca CE.Epidural clonidine or dexmedetomidine for post-cholecystectomy analgesia and sedation.Rev Bras Anestesiol. 2004 Aug;54(4) :473-8.
9. Hala E A Eid, Mohamed A Shafie, Hend Youssef. Dose-related prolongation of hyperbaric bupivacaine spinal anesthesia by dexmedetomidine. Ain Shams Journal of Anesthesiology2011;4(2):83-95.
10. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, et al .Effect of low dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta Anesthesiol Scand 2006; 50:222-7.