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ORIGINAL RESEARCH

Clinical Efficacy of Dexmedetomidine Versus Fentanyl Added to Intrathecal Levobupivacaine for Orthopedic Surgery

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ABSTRACT

Background: The present aim of the study is to compare the clinical efficacy of dexmedetomidine versus fentanyl added to intrathecal levobupivacaine for orthopedic surgeries on the lower limb.

Materials and Methods: The current study was a prospective randomized double-blind comparative study. This study was done in 90 ASA grade I & II patients. The patients were aged between 18 to 60 years scheduled for elective orthopedic surgeries under spinal anaesthesia at Government General Hospital, Kurnool District, Andhra Pradesh. The patients were distributed into three groups (30 patients each). Namely., Group-C [Study group LN:15mg of 0.5% of Levobupivacaine + 0.5 ml of normal saline]-Total-3.5ml, Group-D [Study group LD:15mg of 0.5% of Levobupivacaine + 5 mcg (0.05ml=2 units from insulin syringe) of dexmedetomidine+0.45 ml of normal saline]-Total-3.5ml and, Group-F [Study group LF: 15 mg of 0.5% of Levobupivacaine + 25 mcg of fentanyl]- Total =3.5 ml.

Results: Onset of sensory and motor block,Highest sensory level attained, Time taken to achieve the highest level of sensory analgesia, Time for two segment sensory regression, Duration of complete analgesia, Time for complete recovery of motor block, Haemodynamic effects and Side effects were compared between the dexmedetomidine versus fentanyl added to intrathecal levobupivacaine in orthopaedic surgeries. In this prospective randomizeddouble blind comparative study, the following conclusions were drawn. There is no important statistical disparity between the groups for the time of onset of sensory block (minutes).Time of Onset of Sensory Block was lesser in group D compared to other groups. There is a statistically significant difference between the groups for the time for motor block recovery to Bromage-0 (minutes).The total duration of motor blockade was prolonged in group D compared to groups F and C and it was significant.It was more in group F compared to group C, and it was not that significant. There was no statistically significance difference between three groups at any point of time for MAP (mmHg).There was no statistically significance difference between three groups at any point of time for RR (breaths/minute), RR, and SPO2. The Hypotension was higher in dexmedetomidine group than the fentanyl group and control group. However, there is no association between Hypotension and different groups. The bradycardia was higher in dexmedetomidine group than the fentanyl group and control group. However, there is no association between bradycardia and different groups. Respiratory depression was not observed in any of the three groups and hence was not relevant to our study.

Conclusion: Levobupivacaine is quite useful for lower limb orthopedic surgeries under the lumbar subarachnoid block.Both fentanyl and dexmedetomidine are useful

adjuvants for use along with levobupivacaine and extend analgesia duration in the postoperative period.

Keywords: Fentanyl, Dexmedetomidine, Levobupivacaine, Spinal anaesthesia, MAP, SPO2 Orthopedic surgeries.

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INTRODUCTION

Pain is an area of significant concern in orthopedic surgeries. Despite fixation of fractures, dislocations, soft tissue injury, and trauma, patients do need pain relief during surgery and in the postoperative period. There is a lot of edema and inflammation in the lower limbs following long bone fractures and trauma. The edema and inflammation happens due to extensive surgical dissection, reaming and nailing, and manipulation of the bone cortex and the bone marrow. Fractures of lower limbs incapacitate the patients and also compromise with the bladder and bowel evacuation. Patients find it difficult to evacuate the urinary bladder and rectum and need physical attention. This problem can be minimized by prior urinary catheterization and pain relief in the form of narcotics, centrally acting analgesics, NSAIDs, and steroids like dexamethasone. The excruciating pain due to fractures and trauma of lower limbs leads to a sympathetic drive in the human body.

Anaesthesia is defined as the abolition of sensation, thereby artificially inducing insensibility to pain.[1] Local anaesthetics produce a reversible regional inhibition of sensory nerve impulse conduction, preventing transmission of sensory information to the CNS without losing consciousness. Local anaesthetics may be used alone or in combination with general anaesthetics during surgery to avoid pain, it also attenuate the stress response to surgery, and provide postoperative pain relief.[2] Longer-acting local analgesic agents are also used for other forms of pain management, one of the most common uses being during labor.[1,2]

The most widely used regional anaesthetic procedure for lower limb surgery is a subarachnoid blockade.[2] The spinal block has a fast onset , strong and deep block, easy to administer, and cost-effective.

However,postoperative pain is an important and perennial problem,as the used drugs have a limited duration of action. Hence, postoperative analgesic administration is necessary for continued pain relief. The addition of adjuvant drugs possessing the analgesic property is the trend quite often followed now a days to prolong and extend analgesia duration in the postoperative period and enhance the comfort levels of the patient.[3]

These adjuvants minimize the undesirable hemodynamic side effects of spinal anaesthesia by lowering the requirement of local anaesthetic dose and providing satisfactory quality block. Levobupivacaine is an effective local anesthetic with less systemic toxicity than racemic bupivacaine, but it has a short postoperative analgesic duration compared to racemic variety. Adjuvants like opioids (Morphine, Fentanyl, Sufentanil) and non-opioids like α-2 adrenergic agonists (Clonidine, Dexmedetomidine), anti-cholinesterase (Neostigmine), Midazolam, steroids and Ketamine were used.[4]

Our study studied fentanyl and dexmedetomidine (both preservative-free) as adjuvants to levobupivacaine for enhancing and prolonging the quality and duration of analgesia not only in the operative period but also into the postoperative period.

In various operations, dexmedetomidine and fentanyl have been used as adjuvants of local anesthetics to offer superior analgesia and boost block length.[5]Dexmedetomidine is a highly selective α-2 agonist3 and is somewhat similar to clonidine for its analgesia quality and can also cause hypotension if administered in an intravenous route.

The present study aims to compare the efficacy of dexmedetomidine and fentanyl added to intrathecal levobupivacaine for orthopedic surgeryat the Department of Anaesthesia, Kurnool Medical College, Kurnool, Andhra Pradesh, India.

Aim of the Study:
The present aim of the study is to compare the clinical efficacy of dexmedetomidine versus fentanyl added to intrathecal levobupivacaine for orthopedic surgeries on the lower limb.

Objectives of the Study
The main objectives of the present study are to compare the merits and demerits (if any) of dexmedetomidine with that of fentanyl when added to levobupivacaine for intrathecal administration in lower limb orthopedic surgeries regarding the following parameters:

1. Onset & duration of sensory & motor block.
2. The total duration of analgesia (time for first rescue analgesia).
3. HemodynamicchangesHR,SBP,DBPduring surgeryandinthe postoperative period upto 180 minutes.
4. Side effects.

MATERIALS & METHODS

Source of data:
The study was a prospective, randomised, double-blind comparison study and was performed in 3 groups of 90 ASA grade I and grade II patients. The patients were aged between 18 to 60 years and belonged to both the sexes. The surgeries were on the lower limbs only and were all elective orthopedic surgeries on hemodynamically stable patients. The surgeries were performed at Government General Hospital, Kurnool which is a tertiary care hospital. The patients were divided into 3 groups, each group comprising of 30 patients of both sexes .The first group was designated as group C in which only levobupivacaine was given intrathecally for spinal anesthesia .The second group was designated as Dexmedetomidine(D) group in which dexmedetomidine in a dose of 5micrograms (0.05ml=2units from insulin syringe) was added to 3ml of 0.5%levobupivacaine .The third group was designated as fentanyl (F) group in which 25 micrograms of fentanyl (0.5ml of preservative free) was added to 3ml of 0.5%levobupivacaine for intrathecal administration.
GROUP- C (CONTROL GROUP): 3ml of 0.5% levobupivacaine+0.5ml of normal saline=3.5ml
GROUP -D (DEXMED GROUP): 3 ml of 0.5% levobupivacaine+ 5 micrograms of dexmedetomidine (0.05ml =2units from insulin syringe)+0.45ml of normal saline=3.5ml.
GROUP -F (FENTANYL GROUP): 3 ml of 0.5% levobupivacaine + 25 micrograms (0.5ml) of fentanyl=3.5ml.
The study solutions were prepared by an anesthesiologist not involved in the anaesthesia on the day of surgery. Necessary preoperative evaluation and consent were taken before surgery.

Study Period: The study was performed between June 2019 and October 2020 in Government General Hospital, Kurnool which is the main affiliated hospital of Government Kurnool Medical College.

Method of collection of data:
All the patients were examined by clinically and demographic information such as age, sex, residence and other information on general and systemic examination, case history, past medical history, complaints etc., was collected and recorded in the Proforma prepared for this study purpose.

The patient was preoperatively evaluated by surgical profile which consisted of complete blood picture, random blood sugar, blood urea, serum creatinine and serum electrolytes, ECG, X-ray chest, HbsAg, HIV and HCV and from March 2020 RTPCR for COVID 19 virus.

All patients were kept on Nil by Mouth from midnight and were posted for surgery at 9 AM on the day of surgery. After arriving in OT, an intravenous line was secured with 18 gauge-IV cannulas. A baseline recording of systolic BP and heart rate was taken by taking the mean value of 3 readings of heart rate and blood pressure at one-minute intervals apart. Preloading was done with Hartmann solution (ringer lactate) in a dose of 20 ml/kg body weight prior to performing spinal anaesthesia. Under aseptic precautions, spinal anaesthesia was performed at the L4-L5 space using midline approach in the sitting position with 25-gauge needle. After the injection of local anaesthetic into the intrathecal space in all 3 groups, patients were put into supine position within 60 seconds. Monitoring of vital signs i.e., heart rate, blood pressure (SBP, DBP, MAP), spo2 and standard 3 lead ECG was used in all cases throughout the operative period and postoperative period. Heart rate and blood pressure (SBP, DBP, MAP) were recorded immediately after spinal anesthesia and then every 2min after spinal for the first 10 min and then once every 5min for the next 30 min and then once every 15 min upto 90min after commencement of surgery. If surgery went beyond 90min then BP and pulse rate were recorded every 30 min upto 3 hours after commencement of surgery.

Hypotension is defined as blood pressure less than 90 mm of Hg and a pulse rate going <60beats/min was regarded as bradycardia.

Any hypotension below 90 mm of Hg or <30%of basal value was treated with Mephentermine by bolus or infusion, volume replacement and oxygen mask administration.

Hemodynamic changes in heart rate, SBP, DBP, MAP, spo2 were monitored and recorded before administering subarachnoid block in all the three groups and again at 0,2,4,6,8,10,15,25,30,45,60,75,90,120,150,180 minutes after spinal anesthesia.

Sensory blockade level was assessed by loss of pin prick sensation using a 23-gauge needle on both sides of the abdomen in the mid clavicular line once every 60 seconds to the time of onset of the sensory blockade to T10 level (umbilicus) and later highest sensory level attained and time taken to achieve highest sensory level attained were also recorded.

Later the time to two segment sensory regression from time of intrathecal administration was noted. Time taken for sensory regression to s1 dermatome also was renowned.The duration of sensory blockade was taken as the intervening period from onset of analgesia (sensory block) to return to pin prick sensation at the level of s1 dermatome (sole of the foot and back of the leg).

Onset of the motor block is taken as time interval between injection of drugs into intrathecal space to the time needed to elicit the inability of the patient to lift his lower limb in a straight fashion without flexing his knees (this is usually called as Bromage 3 block)

The duration of motor block is calculated from the time of intrathecal injection to compete regression of motor block as denoted by the ability of the patient to lift his extended lower limb.

Postoperatively pain was assessed by visual analog scale and the level of sedation and comfort assessed by modified Ramsay sedation scale.

Any adverse effects like nausea vomiting bradycardia, hypotension, pruritus, respiratory depression (respiratory rate <10 breaths/ min) and oxygen desaturation (spo2<90%) were recorded and treated accordingly.

Study subjects selection criteria:

Who fulfilled the following conditions were only included the patients in the study.

Inclusion criteria:

- Patients belonging to ASA grade I and II.
- Patients belonging to age 18-60 years.
- Patients giving informed written consent.
- Patients scheduled to undergo elective orthopedic surgeries.

Exclusion criteria:

- Patient refusal for procedure.
- Patients belonging to ASA grade III & IV.
- Coagulopathies.
- Neurological disorders
- Kyphoscoliosis
- Cardiac block or dysarrhythmias.
- Drug allergies.
- Patients with uncontrolled and untreated hypertension and diabetes mellitus
- Patients with renal or hepatic failure
- Fixed cardiac output states

Statistical Analysis:

The data has been entered into MS-Excel and statistical analysis has been done by using IBM SPSS Version 25.0. For categorical variables, the data values are represented as number and percentages. To test the association between the groups, chi-square test was used. For continuous variables, the data values are shown as mean and standard deviation. To test the mean difference between three groups, ANOVA test with post hoc test was used. To test the correlation between the groups, Pearson's correlation test was used. All the p values having less than 0.05 are considered as statistically significant.

RESULTS

In a total of 90 patients, the minimum age was 20 years, maximum age was 45 years and a mean ± SD age was 32.90 ± 7.03 years. Table-1 shows the mean ± SD age in group F was (33.83 ± 6.87 years) slightly higher than the mean ± SD age in group C (33.20 ± 7.49 years), and the mean ± SD age in group D (31.67 ± 6.77 years). However, there is no statistically significant difference between the groups for age. (Overall: P=0.476, C Vs D: P-value = 0.678, C Vs F: P-value = 0.936, and D Vs F: P-value = 0.462).

Table 1: Comparison of age (in years) between the groups

	Control Group (C)	**Dexmedetomidine Group (D)**	**Fentanyl Group (F)**	**P-value**			
				Overall	**C Vs D**	**C Vs F**	**D Vs F**
Age				0.476	0.678	0.936	0.462
	33.20±7.49	31.67±6.77	33.83±6.87				
(Years)				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table2] shows the comparison of height (in cms) between the groups. In a total of 90 patients, the minimum height was 150 cms, maximum height was 168 cms and a mean ± SD

height was 158.07 ± 4.66 cms. Diagrammatic representation shown in [Figure2]. The mean ± SD height in group F is (158.83 ± 4.59 cms) higher than the mean ± SD height in group C (157.87 ± 4.98 cms), and the mean ± SD height in group D (157.5 ± 4.44 cms). However, there is no statistically significant difference between the groups for the height. (Overall: P=0.524, C Vs D: P-value =0.950, C Vs F: P-value = 0.704, and D Vs F: P-value = 0.514).

Table 2: Comparison of height (in cms) between the groups

	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Height				0.524	0.95	0.704	0.514
	157.87±4.98	157.5±4.44	158.83±4.59				
(cms)				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

Table 3: Comparison of weight (kgs) between the groups

	Control Group (C)	Dexmedetomidine Group(D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Weight				0.738	0.716	0.926	0.913
	63.23±4.38	64.07±3.96	63.63±4.05				
(kgs)				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table3] shows the comparison of weight (kgs) between the groups. In a total of 90 patients, the minimum Weight was 52 kgs, maximum Weight was 73 kgs and a mean ± SD Weight was 63.64 ± 4.10 kgs. The mean ± SD Weight in group D (64.07 ± 3.96 kgs) is higher than the mean ± SD Weight in group F (63.63 ± 4.05 kgs), and the mean ± SD Weight in group C (63.23 ± 4.38 kgs). However, there is no statistically significant difference between the groups for the Weight (kgs). (Overall: P=0.738, C Vs D: P-value = 0.716, C Vs F: P-value = 0.926, and D Vs F: P-value = 0.913).

Table 4: Comparison of Time of Onset of Sensory Block (TOSB) to T10 level (in minutes) between the groups

	Control Group (C)	Dexmedetomidine Group(D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
				<0.0001	<0.0001	0.101	0.063
TOSB	2.44±0.67	1.89±0.34	2.19±0.35				
				(VHS)	(VHS)	(NS)	(NS)

[Table4] shows the comparison of TOSB between the groups. In a total of 90 patients, the mean ± SD of TOSB in group C was (2.44 ± 0.67) higher than the mean ± SD of TOSB in group F (2.19 ± 0.35), and the mean ± SD of TOSB in group D (1.89 ± 0.34). The intergroup comparison between groups (CVs F), (F Vs D) is statistically not significant. Comparison between groups (C Vs D) is statistically significant. Group D had less onset time to sensory

block to T10 level when compared to other groups. (Overall: P<0.0001(VHS), C Vs D: P<0.0001, C Vs F: P- value = 0.101 (NS), and D Vs F: P=0.063 (NS).

Table 5: Association between Highest Sensory Level Attained (HSLA) and group

			Group			
			ControlGroup	**DexmedetomidineGroup**	**FentanylGroup**	**Total**
HSLA	T6	Count	13	17	13	43
		% within HSLA	30.2%	39.5%	30.2%	100.0%
		% within Group	43.3%	56.7%	43.3%	47.8%
	T8	Count	17	13	17	47
		% within HSLA	36.2%	27.7%	36.2%	100.0%
		% within Group	56.7%	43.3%	56.7%	52.2%
Total		Count	30	30	30	90
		% within HSLA	33.3%	33.3%	33.3%	100.0%
		% within Group	100.0%	100.0%	100.0%	100.0%

Chi-square value = 1.425, p-value = 0.490 (Not Sig.)

[Table5] shows the association between HSLA and group. In the control group, 13 (43.3%) had T6 and 17 (56.7%) patients had T8, in the Dexmedetomidine group, 17 (56.7%) had T6 and 13 (43.3%) patients had T8, and in the Fentanyl group, 13 (43.3%) had T6 and 17 (56.7%) patients had T8. However, there is no distinct and significant association between HSLA and the groups (P-value=0.490)

Table 6: Comparison of Time to Achieve Highest Sensory Level (TAHSL) (in minutes) between the groups

	Control Group (C)	Dexmedetomidine Group(D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
TAHSL	4.76 ± 0.67	3.74 ± 0.89	4.27 ± 0.74	<0.0001(VHS)	<0.0001(VHS)	0.043(SIG)	0.025(SIG)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

Table 7: Comparison of time for two segment sensory regression [TTSR] (in minutes) between the groups

	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
TTSR	69.73 ± 4.6	150.09 ± 8.87	90.45 ± 5.35	<0.0001 (VHS)	<0.0001 (VHS)	<0.0001 (VHS)	<0.0001 (VHS)

[Table6] shows the comparison of TAHSL between the groups. In a total of 90 patients, the mean ± SD of TAHSL in group C was (4.76 ± 0.67) higher than the mean ± SD of TAHSL in group F (4.27 ± 0.74), and the mean ± SD of TAHSL in group D (3.74 ± 0.89). There is a statistically significant difference between the groups for the TAHSL. The intergroup comparison between groups (C Vs F),(F Vs D) was statistically significant .Comparison between groups (C Vs D) was statistically very highly significant. (Overall: P<0.0001, C Vs D: P<0.0001, C Vs F: P-value = 0.043, and D Vs F: P=0.025)

[Table7] shows the comparison of TTSR between the groups. In a total of 90 patients, the mean ± SD of TTSR in group D was (150.09 ± 8.87) higher than the mean ± SD of TTSR in group F (90.45 ± 5.35), and the mean ± SD of TTSR in group D (69.73 ± 4.6). There is a statistically significant difference between the groups. The intergroup comparison time for two segment sensory regression was prolonged andstatistically very significant in groups F and D when compared to Group C. It was prolonged and statistically very significant in group D compared to group F. (Overall: P<0.0001, C Vs D: P<0.0001, C Vs F: P<0.0001, and D Vs F: P<0.0001).

Table 8: Comparison of Total Duration of Analgesia [TDA] (in hours) between the groups

	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
TDA	3.02 ± 0.46	12.12 ± 2.31	5.72 ± 2.54	<0.0001 (VHS)	<0.0001 (VHS)	<0.0001 (VHS)	<0.0001 (VHS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

The time taken from the intrathecal deposition of drug to first complaint of pain made by the patients. [Table8] shows the comparison of TDA between the groups. In a total of 90 patients, the mean ± SD of TDA in group D was (12.12 ± 2.31) higher than the mean ± SD of TDA in group F (5.72 ± 2.54), and the mean ± SD of TDA in group C (3.02 ± 0.46). There is a statistically significant difference between the groups for the TDA. There was a prolonged duration of analgesia in groups F and D when compared to group C and it was statistically very highly significant. It was prolonged in group D compared to group F, and it was also

statistically very highly significant (Overall: P<0.0001, C Vs D: P<0.0001, C Vs F: P<0.0001, and D Vs F: P<0.0001).

Table 9: Comparison of Time of Onset of Motor Block (TOMB) (in minutes) to Bromage-3 between the groups

	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
				<0.0001	<0.0001	0.062	0.035
TOMB	5.97 ± 0.53	5.24 ± 0.61	5.63 ± 0.62				
				(VHS)	(VHS)	(NS)	(SIG)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table9] shows the comparison of TOMB between the groups. In a total of 90 patients, the mean ± SD of TOMB in group C was (5.97 ± 0.53) higher than the mean ± SD of TOMB in group F (5.63 ± 0.62), and the mean ± SD TOMB in group D (5.24 ± 0.61). There is a statistically significant difference between the groups for the TOMB. The intergroup comparison between groups (C Vs F)was not statistically significant and in between (FVs D) it was statistically significant. Comparison between groups (C Vs D) was statistically very highly significant. Group D had less onset time to motor block Bromage-3 when compared to other groups. (Overall: P<0.0001, C Vs D: P<0.0001, C Vs F: P-value = 0.062, and D Vs F: P=0.035

Table 10: Comparison of Time for Motor Block Recovery (TMBR) to Bromage- 0 (in minutes) between the groups

	Control Group (C)	Dexmedetomidine Group(D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
	131.43 ±			<0.0001	<0.0001	0.113	<0.0001
TMBR		362.52 ± 18.62	140.74 ± 16.26				
	18.53			(VHS)	(VHS)	(NS)	(VHS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table10] shows the comparison of TMBR between the groups. In a total of 90 patients, the mean ± SD of TMBR in group D was (362.52 ± 18.62) higher than the mean ± SD of TMBR in group F (140.74 ± 16.26), and the mean ± SD of TMBR in group C (131.43 ± 18.53). There is a statistically significant difference between the groups for the TMBR. Mean duration of motor block was prolonged in Group D compared to other groups. The intergroup comparison between groups (C Vs F) was statistically not significant. There was a statistically very high significant difference in between groups (C Vs D), (F Vs D) (Overall: P<0.0001, C Vs D: P<0.0001, C Vs F: P-value = 0.113 (Not Sig.), and D Vs F: P<0.0001) (Diagrammatic representation shown in Figure-10).

Table 11: Association between sedation intraoperative and Group

			Group			Total
			ControlGroup	Dexmedetomidine Group	FentanylGroup	
		Count	4	4	2	10
	1	% within Sedation_IOP	40.0%	40.0%	20.0%	100.0 %
Sedatio		% within Group	13.3%	13.3%	6.7%	11.1%
		Count	26	22	25	73
n INTRA	2	% within Sedation_IOP	35.6%	30.1%	34.2%	100.0%
		% within Group	86.7%	73.3%	83.3%	81.1%
OP		Count	0	4	3	7
	3	% within Sedation_IOP	0.0%	57.1%	42.9%	100.0 %
		% within Group	0.0%	13.3%	10.0%	7.8%
Total		Count	30	30	30	90
		% within Sedation_IOP	33.3%	33.3%	33.3%	100.0%
		% within Group	100.0%	100.0%	100.0%	100.0%

Chi-square value = 4.870, p-value = 0.301 (Not Sig.)

[Table11] shows the association between sedation INTRAOP and group. However, there is no significant association between Sedation INTRAOP and the groups (P-value=0.301, Not Sig.).

Table 13: Comparison of Heart Rate (beats/min) between the groups

Heart Rate	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	86.37 ± 10.57	83.37 ± 9.92	84.1 ± 9.7	0.488 (NS)	0.484 (NS)	0.659 (NS)	0.957 (NS)
0min	84.8 ± 10.48	82.5 ± 10.09	83.97 ± 9.3	0.665 (NS)	0.646 (NS)	0.944 (NS)	0.836 (NS)
2min	85.4 ± 13.46	80.5 ± 19.91	83.3 ± 19.13	0.564 (NS)	0.535 (NS)	0.891 (NS)	0.814 (NS)
4min	84.97 ± 14.68	83.73 ± 14.72	83.4 ± 20.84	0.932 (NS)	0.957 (NS)	0.932 (NS)	0.997 (NS)
6min	84.1 ± 15	82.13 ± 15.69	86.47 ±	0.544	0.871	0.818	0.513

			14.81	(NS)	(NS)	(NS)	(NS)
8min	83.73 ± 15.23	79.43 ± 19.16	86.8 ± 15.23	0.232 (NS)	0.578 (NS)	0.756 (NS)	0.206 (NS)
10min	81.8 ± 13.48	80.93 ± 20.13	86.7 ± 14.33	0.338 (NS)	0.977 (NS)	0.476 (NS)	0.359 (NS)
15min	81.67 ± 11.5	82.77 ± 14.1	85.6 ± 13.15	0.482 (NS)	0.942 (NS)	0.471 (NS)	0.675 (NS)
20min	82.37 ± 10.23	81.9 ± 11.42	83.5 ± 10.89	0.842 (NS)	0.985 (NS)	0.914 (NS)	0.836 (NS)
25min	82.57 ± 10.85	81.47 ± 9.86	82.57 ± 9.79	0.890 (NS)	0.908 (NS)	1.000 (NS)	0.908 (NS)
30min	82.67 ± 8.21	81.63 ± 7.55	82.37 ± 8.28	0.877 (NS)	0.872 (NS)	0.989 (NS)	0.933 (NS)
45min	82.53 ± 7.53	82.4 ± 7.44	82.33 ± 8.01	0.995 (NS)	0.997 (NS)	0.994 (NS)	0.999 (NS)
60min	82.5 ± 7.13	82.37 ± 7.09	82.3 ± 7.4	0.994 (NS)	0.997 (NS)	0.994 (NS)	0.999 (NS)
75min	83.1 ± 6.95	83.1 ± 6.84	83.8 ± 7.27	0.906 (NS)	1.000 (NS)	0.921 (NS)	0.921 (NS)
90min	83.87 ± 7.02	83.7 ± 6.8	83.5 ± 7	0.979 (NS)	0.995 (NS)	0.977 (NS)	0.993 (NS)
120min	84.43 ± 6.13	84.57 ± 6.49	84.17 ± 6.14	0.969 (NS)	0.996 (NS)	0.985 (NS)	0.967 (NS)
150min	84.47 ± 6.12	84.13 ± 6.33	84.17 ± 5.98	0.974 (NS)	0.976 (NS)	0.980 (NS)	1.000 (NS)
180min	83.37 ± 5.85	80.73 ± 14.85	83.63 ± 5.2	0.444 (NS)	0.546 (NS)	0.994 (NS)	0.481 (NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table13] shows the comparison of heart rate between the groups. The comparison of means of heart rate at different intervals (from baseline to 180 minutes) were shown in above table and it was inferred that there was no statistically significance difference between three groups at any point of time for heart rate (P>0.05)

Table 14: Comparison of Systolic Blood Pressure (SBP) (in mm of Hg) between the groups

SBP	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	115.53±4.67	115.33±4.60	115.33±4.60	0.981	0.985	0.985	1.000
				(NS)	(NS)	(NS)	(NS)
0min	112.07±7.31	111.90±7.39	115.40±4.58	0.071	0.995	0.126	0.103
				(NS)	(NS)	(NS)	(NS)
2min	111.90±8.33	105.2±26.61	111.90±7.39	0.204	0.269	1.00	0.269
				(NS)	(NS)	(NS)	(NS)
4min	108.93±7.91	108.93±8.25	111.53±8.43	0.370	1.000	0.440	0.440
				(NS)	(NS)	(NS)	(NS)
6min	112.50±7.42	111.60±8.11	108.87±7.71	0.174	0.895	0.171	0.364

				(NS)	(NS)	(NS)	(NS)
8min	109.57±8.07	109.13±8.91	112.00±8.21	0.367	0.978	0.504	0.388
				(NS)	(NS)	(NS)	(NS)
10min	110.30±8.36	110.53±9.03	109.30±10.04	0.858	0.995	0.906	0.861
				(NS)	(NS)	(NS)	(NS)
15min	110.17±7.26	109.07±8.68	110.27±6.88	0.797	0.843	0.999	0.816
				(NS)	(NS)	(NS)	(NS)
20min	112.30±5.81	110.93±8.63	111.03±8.47	0.749	0.774	0.802	0.999
				(NS)	(NS)	(NS)	(NS)
25min	111.87±5.27	111.67±5.30	111.87±5.27	0.986	0.988	1.000	0.988
				(NS)	(NS)	(NS)	(NS)
30min	112.10±3.74	112.03±3.76	112.10±3.74	0.997	0.997	1.000	0.997
				(NS)	(NS)	(NS)	(NS)
45min	111.20±4.18	107.60±18.36	111.20±4.18	0.356	0.426	1.000	0.426
				(NS)	(NS)	(NS)	(NS)
60min	109.60±3.93	109.67±3.99	109.60±3.82	0.997	0.998	1.000	0.998
				(NS)	(NS)	(NS)	(NS)
75min	111.57±4.52	111.57±4.47	111.40±4.47	0.986	1.000	0.989	0.989
				(NS)	(NS)	(NS)	(NS)
90min	110.47±4.01	110.60±4.07	110.37±3.91	0.975	0.991	0.995	0.972
				(NS)	(NS)	(NS)	(NS)
120min	110.63±4.73	110.50±4.63	110.50±4.63	0.992	0.993	0.993	1.000
				(NS)	(NS)	(NS)	(NS)
150min	111.70±4.50	111.70±4.50	111.63±4.51	0.998	1.000	0.998	0.998
				(NS)	(NS)	(NS)	(NS)
180min	110.93±4.55	110.83±4.51	110.83±4.51	0.995	0.996	0.996	1.000
				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table14] shows the comparison of systolic blood pressure (SBP) between the groups. The comparison of means of SBP at different intervals (from baseline to 180 minutes) were shown in above table and it was inferred that there was no statistically significance difference between three groups at any point of time for SBP (P>0.05)

Table 15: Comparison of Diastolic Blood Pressure (DBP) (in mm of Hg) between the groups

DBP	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	68.1±5.27	68.03±5.32	68.03±5.32	0.998	0.999	0.999	1.000
				(NS)	(NS)	(NS)	(NS)
0min	67.1±5.82	67.2±5.72	67.9±5.4	0.837	0.997	0.848	0.881
				(NS)	(NS)	(NS)	(NS)
2min	67.37±5.87	67.57±5.78	67.2±5.72	0.970	0.990	0.993	0.967
				(NS)	(NS)	(NS)	(NS)
4min	64.73±13.62	66.27±8.14	67.57±5.78	0.532	0.815	0.501	0.863

				(NS)	(NS)	(NS)	(NS)
6min	63.53±6.95	63.1±6.89	66.37±8.04	0.177	0.971	0.296	0.200
				(NS)	(NS)	(NS)	(NS)
8min	64.8±6.43	64.93±6.28	63.5±7.05	0.650	0.997	0.726	0.678
				(NS)	(NS)	(NS)	(NS)
10min	63.43±6.15	63.63±5.86	62.67±6.94	0.823	0.992	0.886	0.825
				(NS)	(NS)	(NS)	(NS)
15min	65.97±6.78	65.5±7.6	65.97±6.78	0.957	0.965	1.000	0.965
				(NS)	(NS)	(NS)	(NS)
20min	66.37±7.74	65.33±8.58	65.3±8.5	0.852	0.879	0.872	1.000
				(NS)	(NS)	(NS)	(NS)
25min	66.4±5.18	66.37±5.16	66.4±5.18	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
30min	66.1±4.94	66.1±4.94	66.1±4.94	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
45min	63.47±4.97	63.47±4.97	63.47±4.97	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
60min	65.33±6.07	65.2±6.23	65.5±6.24	0.982	0.996	0.994	0.981
				(NS)	(NS)	(NS)	(NS)
75min	68.2±5.25	68.33±5.35	68.2±5.25	0.994	0.995	1.000	0.995
				(NS)	(NS)	(NS)	(NS)
90min	68.47±5.04	68.47±5.04	68.27±4.84	0.984	1.000	0.987	0.987
				(NS)	(NS)	(NS)	(NS)
120min	66.73±6.69	66.8±6.75	66.8±6.75	0.999	0.999	0.999	1.000
				(NS)	(NS)	(NS)	(NS)
150min	66.03±4.76	66.2±4.88	66.23±4.88	0.985	0.990	0.986	1.000
				(NS)	(NS)	(NS)	(NS)
180min	65.43±5.61	65.83±5.64	65.57±5.72	0.962	0.960	0.995	0.982
				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table15] shows the comparison of diastolic blood pressure (DBP) between the groups. The comparison of means of DBP at different intervals (from baseline to 180 minutes) were shown in above table and it was inferred that there was no statistically significance difference between three groups at any point of time for DBP(P>0.05) (Diagrammatic representation shown in Figure-15).

Table 16: Comparison of Mean Arterial Pressure (MAP) (in mm of Hg) between the groups

MAP	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	83.90±3.43	83.80±3.50	83.80±3.50	0.992	0.993	0.993	1.000
				(NS)	(NS)	(NS)	(NS)
0min	82.07±5.63	82.10±5.63	81.63±4.97	0.933	1.000	0.949	0.941
				(NS)	(NS)	(NS)	(NS)

2min	82.23±5.04	82.23±5.04	82.1±5.63	0.994	1.000	0.995	0.995
				(NS)	(NS)	(NS)	(NS)
4min	80.67±6.55	80.50±6.81	82.23±5.04	0.491	0.994	0.590	0.525
				(NS)	(NS)	(NS)	(NS)
6min	79.83±5.89	79.23±6.06	80.53±6.54	0.717	0.925	0.899	0.694
				(NS)	(NS)	(NS)	(NS)
8min	79.67±5.90	79.63±6.01	79.63±6.19	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
10min	79.03±5.57	78.17±6.94	78.57±7.11	0.878	0.866	0.959	0.970
				(NS)	(NS)	(NS)	(NS)
15min	80.70±6.51	80.07±7.59	80.73±6.38	0.914	0.932	1.000	0.925
				(NS)	(NS)	(NS)	(NS)
20min	81.70±5.95	80.53±7.49	80.57±7.32	0.761	0.793	0.803	1.000
				(NS)	(NS)	(NS)	(NS)
25min	81.57±4.54	81.53±4.53	81.57±4.54	0.999	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
30min	81.37±3.86	81.37±3.86	81.37±3.86	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
45min	79.43±4.20	79.33±4.17	79.43±4.20	0.994	0.995	1.000	0.995
				(NS)	(NS)	(NS)	(NS)
60min	80.00±4.42	80.07±4.51	80.20±4.60	0.985	0.998	0.984	0.993
				(NS)	(NS)	(NS)	(NS)
75min	82.60±4.30	82.73±4.37	82.60±4.30	0.991	0.992	1.000	0.992
				(NS)	(NS)	(NS)	(NS)
90min	82.40±4.16	82.43±4.17	82.57±4.28	0.987	0.999	0.987	0.992
				(NS)	(NS)	(NS)	(NS)
120min	81.33±5.13	81.33±5.13	81.33±5.13	1.000	1.000	1.000	1.000
				(NS)	(NS)	(NS)	(NS)
150min	81.17±3.66	81.63±4.29	81.30±3.72	0.892	0.889	0.990	0.941
				(NS)	(NS)	(NS)	(NS)
180min	80.60±4.28	81.17±4.78	80.67±4.33	0.866	0.876	0.998	0.902
				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table16] shows the comparison of MAP between the groups. The comparison of means of MAP at different intervals (from baseline to 180 minutes) were shown in above table and it was inferred that there was no statistically significance difference between three groups for MAP (P>0.05).

Table 17: Comparison of Respiratory Rate (RR) (breaths/minute) between the groups

RR	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	14.40±0.67	14.47±0.51	14.43±0.50	0.902	0.892	0.972	0.972

				(NS)	(NS)	(NS)	(NS)
0min	14.17±0.65	14.47±0.57	14.20±0.85	0.196	0.225	0.981	0.306
				(NS)	(NS)	(NS)	(NS)
2min	14.23±0.68	14.43±0.57	14.33±0.61	0.461	0.427	0.807	0.807
				(NS)	(NS)	(NS)	(NS)
4min	14.17±0.65	14.10±0.55	14.17±0.59	0.883	0.902	1.000	0.902
				(NS)	(NS)	(NS)	(NS)
6min	14.17±0.65	14.20±0.76	14.30±0.60	0.727	0.980	0.723	0.980
				(NS)	(NS)	(NS)	(NS)
8min	14.27±0.74	14.43±0.73	14.20±0.66	0.428	0.637	0.930	0.416
				(NS)	(NS)	(NS)	(NS)
10min	14.20±0.66	14.33±0.55	14.27±0.52	0.675	0.648	0.897	0.897
				(NS)	(NS)	(NS)	(NS)
15min	14.27±0.69	14.23±0.73	14.47±0.63	0.364	0.981	0.497	0.387
				(NS)	(NS)	(NS)	(NS)
20min	14.23±0.82	14.33±0.55	14.50±0.57	0.288	0.826	0.263	0.590
				(NS)	(NS)	(NS)	(NS)
25min	14.20±0.76	14.57±0.57	14.40±0.81	0.150	0.127	0.534	0.179
				(NS)	(NS)	(NS)	(NS)
30min	14.03±0.76	14.20±0.61	14.13±0.68	0.642	0.618	0.840	0.925
				(NS)	(NS)	(NS)	(NS)
45min	14.17±0.65	14.30±0.53	14.47±0.57	0.146	0.654	0.123	0.516
				(NS)	(NS)	(NS)	(NS)
60min	14.13±0.73	14.23±0.77	14.30±0.65	0.667	0.853	0.644	0.932
				(NS)	(NS)	(NS)	(NS)
75min	14.10±0.66	14.40±0.67	14.40±0.62	0.127	0.183	0.183	1.000
				(NS)	(NS)	(NS)	(NS)
90min	14.23±0.68	14.40±0.56	14.23±0.63	0.493	0.558	1.000	0.558
				(NS)	(NS)	(NS)	(NS)
120min	14.27±0.64	14.37±0.67	14.30±0.65	0.834	0.824	0.979	0.918
				(NS)	(NS)	(NS)	(NS)
150min	14.40±0.72	14.17±0.70	14.33±0.61	0.394	0.381	0.923	0.609
				(NS)	(NS)	(NS)	(NS)
180min	14.37±0.72	14.40±0.50	14.47±0.57	0.808	0.975	0.797	0.904
				(NS)	(NS)	(NS)	(NS)

VHS: Very High Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table17] shows the comparison of RR between the groups. The comparison of means of RR at different intervals (say, baseline to 180 minutes) were shown in above table and it was inferred that there was no statistically significance difference between three groups for respiratory rate (P>0.05).

Table 18: Comparison of mean values of SPO2 at different time intervals between the groups

SPO2	Control Group (C)	Dexmedetomidine Group (D)	Fentanyl Group (F)	P-value			
				Overall	C Vs D	C Vs F	D Vs F
Baseline	99.07±0.94	99.07±0.78	98.83±0.91	0.501	1.000	0.564	0.564
				(NS)	(NS)	(NS)	(NS)
0min	96.1±16.47	99.27±0.74	99.23±0.73	0.340	0.406	0.414	1.000
				(NS)	(NS)	(NS)	(NS)
2min	98.70±0.84	99.23±0.63	99.00±0.69	0.200	0.015	0.250	0.429
				(NS)	(NS)	(NS)	(NS)
4min	98.77±1.01	99.00±0.79	98.63±0.67	0.231	0.526	0.810	0.209
				(NS)	(NS)	(NS)	(NS)
6min	99.00±0.87	98.87±0.86	98.73±0.74	0.461	0.807	0.427	0.807
				(NS)	(NS)	(NS)	(NS)
8min	98.83±0.87	98.97±0.96	98.87±0.82	0.833	0.830	0.988	0.988
				(NS)	(NS)	(NS)	(NS)
10min	98.93±0.87	98.87±0.97	98.60±0.93	0.341	0.958	0.348	0.507
				(NS)	(NS)	(NS)	(NS)
15min	98.77±0.82	99.10±0.88	98.87±0.86	0.306	0.291	0.893	0.543
				(NS)	(NS)	(NS)	(NS)
20min	99.07±0.98	99.03±0.85	98.60±0.72	0.069	0.988	0.094	0.129
				(NS)	(NS)	(NS)	(NS)
25min	98.87±0.90	99.00±0.79	98.90±0.76	0.806	0.803	0.986	0.884
				(NS)	(NS)	(NS)	(NS)
30min	98.80±0.85	99.03±0.72	98.77±0.68	0.330	0.455	0.984	0.359
				(NS)	(NS)	(NS)	(NS)
45min	98.73±0.83	98.63±0.85	98.60±0.77	0.806	0.884	0.803	0.986
				(NS)	(NS)	(NS)	(NS)
60min	98.90±0.88	98.93±1.01	98.70±0.84	0.567	0.989	0.675	0.587
				(NS)	(NS)	(NS)	(NS)
75min	98.63±0.89	99.03±0.76	98.67±0.71	0.101	0.130	0.985	0.178
				(NS)	(NS)	(NS)	(NS)
90min	98.83±0.91	99.23±0.90	98.87±0.78	0.145	0.178	0.943	0.233
				(NS)	(NS)	(NS)	(NS)
120min	99.03±0.76	99.30±0.88	98.93±0.74	0.189	0.400	0.878	0.181
				(NS)	(NS)	(NS)	(NS)
150min	99.07±0.91	98.80±0.89	98.57±0.82	0.090	0.465	0.073	0.556
				(NS)	(NS)	(NS)	(NS)
180min	99.07±0.83	98.63±0.93	98.93±0.78	0.135	0.124	0.816	0.362
				(NS)	(NS)	(NS)	(NS)

VHS: Very Highly Significant (P<0.0001); SIG: Significant (P<0.05); NS: Not Significant (P>0.05)

[Table18] shows the comparison of SPO2 between the groups. The comparison of means of SPO2 at different intervals (from baseline to 180 minutes) were shown in the above table and it was inferred that there was no statistically significance difference between three groups for SPO2 (P>0.05)

DISCUSSION

The subarachnoid blockade is the most commonly used regional anesthetic technique for lower limb surgeries.It is easy to perform, produces rapid onset of anaesthesia and complete muscle relaxation, and is also economical. A relatively short duration of action sometimes offsets these advantages.

Levobupivacaine is considered to be a safe drug in clinical practice with no serious side effects. The cardiotoxicity seen with racemic routinely used bupivacaine is also not a significant issue with levobupivacaine. That is precisely the reason why levobupivacaine was introduced into clinical practice as a part of the continuous ongoing search for safer new local analgesic drugs. Now a days, ropivacaine in strengths of 0.2%, 0.5% and 0.75% is used in Indian anesthetic practice as an alternative to 0.5% bupivacaine with reasonable degree of success.

The commonly used adjuvants to augment and increase the quality of analgesia in the intraoperative period and also extend the duration of postoperative analgesia are many and the choice of an appropriate drug for this beneficial purpose is sometimes difficult and confusing.

In this study, we selected fentanyl and dexmedetomidine as adjuvants to levobupivacaine so as to extend the duration of postoperative analgesia in lower limb orthopedic surgeries and also assess their efficacy.

The discovery of opioid receptors in the brain and spinal cord started a new era in the field of postoperative analgesia.[5,6] The first clinical use of intrathecal opiods was by Wang et al.[7]

The use of neuraxial opioids has increased dramatically over the last few years. They improve the quality of intraoperative analgesia produced by local anaesthetics, by binding directly with the spinal opiate receptor and prolong the duration of postoperative analgesia. Opioids administered in subarachnoid space appear to act principally on μ receptor in substantia gelatinosa of the dorsal horn of spinal cord by suppressing excitatory neuropeptide release from C- fibres.[8] The combination of local anaesthetics and opioids, allow a reduction in both doses of drugs, thus lessening the side effects attributable to each. Fentanyl is a potent lipophilic opioid. It is a μ receptor agonist with a short onset time and moderate duration of action.[9]

The mechanism by which intrathecal α-2 adrenoreceptor agonists prolong the motor and sensory block of local anaesthetics is not well understood. The prolongation of effects might result from synergism between the local anaesthetic and α-2 adrenoreceptor agonists. Dexmedetomidine, an imidazole compound, is the pharmacologically active dextroisomer of medetomidine and is used nowadays in ICU for its prolonged analgesic and sedative properties.

There are limited studies in the literature comparing the benefits and side effects of fentanyl and dexmedetomidine as intrathecal adjuvants to levobupivacaine for orthopedic lower limb surgeries. As levobupivacaine has a reasonable safety profile and as fentanyl and dexmedetomidine are already established drugs with assured analgesic properties, we selected the above three drugs for spinal anaesthesia for lower limb surgeries.

Efficacy of intrathecal block, haemodynamic stability, postoperative analgesia and side effects were the criteria selected for assessment.

Dexmedetomidine which is alpha-2 agonist produces sedation, analgesia, adequate hemodynamic stability, amnesia, and anti-sialagogues effects. It produces sedation which

resembles natural sleep but arousable through the post synaptic receptors in locus coeruleus with minimal respiratory depression action.

Comparison of Study Parameters with Other Studies Sensory Characteristics

Time of onset of sensory block to T10:

In the present study, the mean onset time for the sensory block to T10 level in group D was less and quicker compared to other groups.

Comparison between group C and group D was statistically significant (p<0.0001)in our study,similar to studies of Shukla et al. (2011).[10]Marothia et al.[2] study not correlates with our study where onset of action was fast in fentanyl group compared to dexmedetomidine group .

In our study, comparison between group F and group D was not statistically significant(p-value-0.063). This finding is not similar to studies of Lotfy et al. (2020),[11] where the comparison between groups F and D was statistically significant

In our study comparison between group C and group F was not statistically significant (p - value:0.101). This study of ours not in correlation with the study of Rastogi et al. (2020) where they observed statistically significant difference between the groups C and F.[12]

Highest sensory level attained:

In this study, the highest sensory level attained was T6 but it was not specific to any of the three groups and was seen in all the three groups Majority of patients in all the three groups attained the highest sensory level of T8.The difference between ock was statistically not significant (P=0.490).

Time to achieve highest sensory blockade:

In our study, the mean time taken to reach the highest sensory level is less in group D than in other groups.This study of ours not correlates with the study of Bhure and Jagtap (2019),[13]Rastogi et al. (2020),[12]where onset of sensory block earlier in fentanyl.

Comparison between dexmedetomidine and control was statistically significant (p-value:0.068).This study of ours correlates with study of Shukla et al. (2011)[24]

Time for two segment regression of sensory block:

In this study, the mean time for two segment regression was more in the dexmedetomidine group than in other groups. Intrathecal dexmedetomidine combined with spinal bupivacaine prolongs the sensory block through suppression of C-fibre transmitter release and hyperpolarization of postsynaptic dorsal horn Neurons. A significant difference was observed in between group C and group F(P<0.0001) in this study. Fentanyl group has more time for two segment regression than the control group. This is also seen in studies done by Mahendruet al (2013).[2]In other words, addition of fentanyl and dexmedetomidine to levobupivacaine prolongs the duration of sensory block and delays the time to two segment regression.

In the present study, Comparison between groups F and D was statistically Significant(p-value-<0.0001). Group D has prolonged two segment regression time than group F. This finding is in correlation with studies done by Rajni Gupta et al. (2011).[3]

Motor block characteristics:

Time of Onset of Motor Block to Brom GE Scale 3:

In the present study, the mean time of onset of the motor block to BROMAGE SCALE 3 in group D was less compared to other groups. Comparison between group C, and group F was not statistically significant(p-vaue-0.062).This result is similar with studies done by Rastogi

et al. (2020).[12] The present study of ours not in correlation with the study of Mahmoud et al. (2020),[14]where fentanyl has statistically significant relation with levobupivacaine group. In the present study, comparison between group C and group D was statistically significant (p-value-<0.0001). This finding is consistent with studies done by Kanazi, et al. (2006),[15] Shukla et al. (2011),[10] where they observed that addition of Dexmedetomidine results in lesser time for onset of the motor block.
In our study time of onset of motor block was less in dexmedetomidine when compared to fentanyl. This study of ours is not correlate with the study of Megalla Sohair (2018).[17] In this study dexmedetomidine has no impact on time of onset of motor block.

Duration of motor block (time for motor block recovery to bromage scale-0):
In the present study, mean duration of motor block in group D was significantly prolonged when compared with groups F and C. This result of our study correlates with the study of Rastogi et al. (2020).Prolongation of motor block in group D might result from the binding of α-2 adrenoreceptor agonists to motor neurons. Comparison between groups C and F were statistically not significant(p- value-0.113) with regards to duration of motor block. In this study, comparison between groups C and D was statistically significant (p-value-<0.0001) with duration of motor block larger in dexmedetomidine group. This finding is in correlation with studies done by Shukla et al. (2011).[10]

Total duration of analgesia (time for first rescue analgesia):
In the present study, the mean total duration of analgesia was prolonged in the dexmedetomidine group when compared to fentanyl and control group. This is similar to the study of Rastogi et al. (2020),[12] where time to first rescue analgesia was prolonged in Group D than Group F and control group. On comparison with control, both fentanyl and dexmedetomidine showed significantly prolonged total duration of analgesia. This significant difference of dexmedetomidine with control was similar to studies done by,Lofty et al. (2020).[11]

Haemodynamic parameters:
Heart Rate (HR):
In the present study, the baseline heart rate before dural puncture did not show a significant difference between the three groups. Heart rate started to decrease after spinal anaesthesia in all the groups at different times of measurement. This decrease, however, was not statistically significant among the three groups. This study of ours with regards to heart rate correlates with the studies of Kanazi, et al. (2006),[23]Shukla et al. (2011).[24]

Mean Arterial Pressure (MAP)
In the present study, at baseline, mean arterial pressure before dural puncture was compared and did not show a significant difference between the three groups. MAP started to decrease after spinal anaesthesia in all the groups at different times of measurement. This decrease, however, was not statistically significant among the three groups (P>0.05). This results of our study correlates with the studies of Kanazi, et al. (2006),Shukla et al. (2011),Gulec et al. (2014).[10,15,17]

Respiratory Rate (RR):
In the present study, there was no statistically significance difference between three groups at any point of time interval for RR (P>0.05).Respiratory depression was not observed in all the three groups .This study of ours correlates with the study of Ravikumar and Kalasree (2017).[18]

Side effects:

Hypotension:

In this study, the incidence of hypotension was 16.7% in levobupivacaine (control group), 20% in levobupivacaine +fentanyl group, and 23.33% in levobupivacaine+ dexmedetomidine group. The hypotension was maximum in the dexmedetomidine group and the least in the plain levobupivacaine group with the fentanyl group in the intermediate position. This can be explained by the fact that of all the three drugs mentioned above,dexmedetomidine is the drug most likely to cause hypotension by virtue of its alpha-2 agonist effects and also because of its actions on the substantia gelatinosa and C fibres in the spinal cord. drug injected into the subarachnoid space than due to fentanyl alone.

Bradycardia:

Bradycardia is the commonly associated finding with hypotension in spinal anaesthesia. It was seen in all the three groups with the incidence being 6.67% in both levobupivacaine and fentanyl groups and 10% in dexmedetomidine group. In this study, Bradycardia patients were treated with 0.6mg atropine i.v. if pulse rate went below 60/min. Hypotension was treated with volume challenge and small bolus doses of Mephentermine in doses of 3 mg i.v.

Nausea and vomiting:

Nausea and vomiting were seen in all the three groups in this study. The maximum incidence was observed in fentanyl group (10%) and the other two groups (Levobupivacine group, Levobupivacaine +dexmedetomidine group) were similar with regards to incidence of nausea and vomiting (6.67%). This can be explained by the fact that dexmedetomidine is used in the ICU sedation on ventilated patients because of its low risk to produce nausea and vomiting and aspiration of gastric contents.

Pruritus:

Pruritus was observed only in the fentanyl group (3.3%) and was not seen in levobupivacine group and dexmedetomidine group.This can be explained by the fact that pruritus is the common side effects of epidural /intrathecal administered narcotics.But the association between the three groups with regards to incidence of pruritus was not that statistically significant (P=0.364)and our findings correlates with the study of Megalla Sohair (2018). [16]

Respiratory depression:

Respiratory depression was not seen in any of the three groups and hence statistically irrelevant.

Limitations of the Study:

The present study has the following limitations. They are.,

- The present studywas done in 30patients of each group,and sample size is less .
- Patients belongs to ASA I / II.
- Sinceblood lossvarieswithdifferenttypesoforthopedicsurgeries.

Comparison of haemodynamic changes was less reliable, as haemodynamic parameters which also depends on blood loss.

- As the patients were undergoing elective orthopedic surgeries under spinal anaesthesia, patients were steady the measurements of body weight were impossible.

CONCLUSION

- Levobupivacaine is quite useful for lower limb orthopedic surgeries under the lumbar subarachnoid block.
- Both fentanyl and dexmedetomidine are useful adjuvants for use along with levobupivacaine and extend analgesia duration in the postoperative period.
- Dexmedetomidine provides significant and long-lasting analgesia into the postoperative period and, in this aspect, scores over fentanyl as an adjuvant along with levobupivacaine.
- Dexmedetomidine also provides a significant early onset of sensory block and motor block a longer duration of motor block and sensory block with minimal need for rescue analgesia in the first 24 hours of the postoperative period.
- Fentanyl contributes to the enhancement of motor block in combination with levobupivacaine and enhances analgesia duration in the intraoperative and postoperative period.
- Haemodynamics is well maintained with all three drugs and is not a matter of concern in lower limb orthopedic surgeries.
- Side effects are negligible and readily treatable in all three groups and are not statistically relevant.
- To conclude dexmedetomidine is a better adjuvant to levobupivacaine than fentanyl in the lumbar subarachnoid block for lower limb orthopedic surgeries.
- Levobupivacaine alone or in combination with either fentanyl or dexmedetomidine is a beneficial and viable option of anesthesia for lower limb orthopedic surgeries under spinal anesthesia with assured safety.

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