

Comparison of Intrathecal Dexmedetomidine and Fentanyl as an adjuvant to Levobupivacaine for postoperative Analgesia in Knee surgeries of Gujarat Population: Retrospective Study

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Abstract:

Background: Anesthesia for knee surgeries can be administered by various modes. Spinal anesthesia is most commonly used technique because of its quick onset, excellent blockage, low infection risk and affordability. Most widely used drug is hyperbaric Bupivacaine (0.5%).

Method: Out of fifty (50) patients, 25(Group F) were administered isobaric levobupivacaine (0.5%, 2.8ml) and fentanyl (25mcg, 0.5ml), total volume: 3.3 ml. 25(Group D) were administered isobaric levobupivacaine (0.5%, 2.8 ml) and Dexmedetomidine (10mcg, diluted in normal saline), total volume 3.3 ml. The analgesic effects of both drugs were monitored post operatively. The VAS score for both drugs was noted and compared.

Results: Comparison of time to give first rescue analgesia, time to reach peak sensory level, total duration of motor blockade, time to 2 sensory level regression, hemodynamic parameters between two group had a significant p value ($p < 0.001$) and the least side effects were noted in GROUP D.

Conclusion: Time to give first dose of post-operative rescue analgesia was more in GROUP D with prolonged sensory and motor blockade, with more side effects in GROUP F as compared to GROUP D, GROUP D drug preferred over GROUP F drug in patient undergoing knee surgeries.

Keywords: VAS score, modified Bromage scale, Levobupivacaine, Dexmedetomidine, Fentanyl, rescue analgesia.

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Introduction

It is an established fact that intrathecal anesthesia has been the preferred method of analgesia and anesthesia in patient undergoing lower limb knee surgeries [1]. The medications such as local anaesthetics administered through these techniques are more effective than those administered through other routes. Knee joint surgeries can be conducted under regional or general anesthesia.

Although spinal anesthesia has limitations such as a shorter period of block and inadequate postoperative analgesia it is still a preferred option due to its rapid onset, simplicity of technique, higher success rates, cost effectiveness and avoids risk associated with general anaesthesia [2].

Since its introduction in 1856, Bupivacaine (0.5%) has been the preferred medication for spinal anesthesia due to its extended duration of sensory and motor blockade however it is linked with cardiac

and nervous system toxicity [3]. Levobupivacaine (0.5%), which is S enantiomer of Bupivacaine has increased protein binding and higher clearance and henceforth more cardiostable; came into play.

The addition of various adjuvants intrathecally helps in reducing dose of local anaesthetics, prolonging duration of action with more hemodynamical stability. Dexmedetomidine a new highly selective α_2 against is under evaluation as a neuro axial adjuvant as it provides stable hemodynamic stability.

Dexmedetomidine and fentanyl have been used as adjuvants to various LA to provide superior analgesia and to improve the duration of block [4]. Hence, an attempt was made to compare a combination of isobaric levobupivacaine with fentanyl and dexmedetomidine to evaluate the spinal blockade with respect to onset, duration, hemodynamicity, side

effects, and post-operative analgesia in knee surgeries.

Material and Method

50 (fifty) patients aged between 18 to 70 years at Pramukswami Medical College and Shree Krishna Hospital, Karamsad, Gujarat-388325 were studied.

Inclusive Criteria: Patients having ASA-I-III physical status and elective lower limb surgeries, who gave their written consent, were selected for the study.

Exclusion Criteria: Patients with hypersensitivity to amide and ester local anesthesia, having absolute contraindications to spinal anesthesia, patients with bleeding disorders, hypertension, cardiac problems, head injuries, and pregnant females were excluded from the study.

Method: The patients undergoing knee surgery were classified into two groups by virtue of lottery system. Group F-25 patients were given 0.5% Iso-baric Levobupivacaine 2.8 mL + 25 mcg Fentanyl, total volume 3.3 mL.

Group D 25 patients were given 0.5% levobupivacaine isobaric 2.8 ml + 10mcg dexmedetomidine (diluted with normal saline), total value of 3.3 ml. (25 patients in group F and 25 in group D).

Preoperative: Every patient's detailed clinical, general, and systemic history, general and systemic examination was carried out. A complete blood count (CBC), blood sugar, renal profile, serum electrolytes, and ECG (electrocardiogram) were done, after confirming the overnight fasting for 8 hours, all patients were preloaded with Ringer lactate solution (10 mL/kg) over 15 minutes before the spinal anesthesia.

Intra-operative:

In the operation room, an electrocardiogram and pulse oximeter is attached for monitoring purposes. Under all strict aseptic precaution, subarachnoid block (spinal anesthesia) was performed using a spinal needle in the intervertebral space after infiltrating the area with the local anesthetic solution. A mixture of drugs as per the assignment was injected after obtaining a free and clear flow of CSF. Immediately after block, the patients were turned supine.

The time of injection was noted as "O". Assessment of sensory and motor characteristics of the subarachnoid block was done as per the grading shown in Table at every 30-second interval until the peak of the blockade was achieved.

The sensory block was assessed by skin sensation to pinprick, using the sterile 24G hypodermic nee-

dle, and the motor block was assessed according to the modified Borge scale.

Postoperatively: Time to the first analgesic requirement was monitored to assess the analgesic effects in both drug groups. [Time to first post-operative analgesia would be when VAS score >3 on rest VAS or when score >5 on movement (dorsiflexion)]. The VAS score was assessed every 40 minutes, until 6 hours post-surgery, for the first analgesic requirement.

Duration of study: May 2019 to November 2021

Statistical analysis: A comparison of various parameters was made between both Group-F and Group D with t test and significant p value was noted. The statistical analysis was carried out in SPSS software. The ratio of males and females was 2:1.

Observation and Results

Table 1: Comparison of sensory characteristics of subarachnoid blocks in both groups

The onset (minutes) was 4.88 (\pm 1.1) in group D, 2.15 (\pm 09) in group F, and $p < 0.001$. Time of sensory level (min): 7.83 (\pm 1.5) in group D, 4.64 (\pm 1.3) in group F, and $p < 0.001$, Peak level (min): 13.8 (\pm 3.1) in group D, 8.7 (\pm 5.9) in group F and $p < 0.001$. Time to 2 sensory level regression (min): 103.6 (\pm 25.8) in group D, 51.4 (\pm 39.2) in group F, and $p < 0.001$. Time to reach S2 sensory level (minutes): 356.4 (\pm 54.6) in group D, 232.7 (\pm 55.2) in group F, and $p < 0.001$.

Table 2: Comparison of duration of elective analgesia in both groups: 361.04 (\pm 58.5) in group D, 249.3 (\pm 55.7) in group F, and $p < 0.001$.

Table 3: Comparison of VAS scores in both groups: VAS scores at 120 minutes, 180 minutes, 210 minutes, 240 minutes, and 270 minutes were highly significant.

Table 4: Comparison of oxygen saturation amongst study groups, At the base line of 30 minutes and 40 minutes, there was a significant p value ($p < 0.001$).

Table 5: Comparison of individual side effects in both groups

- Shivering was observed only in group D in 10 (40%) patients).
- Nausea was observed in 1 (4%) patient in group D and 16 (64%) patient in group F
- Vomiting was observed only in group F, 15 (52%) patients.
- No pruritis, no respiratory depression, and no urinary retention were observed in any group.

Table 1: Comparison of sensory characteristics of subarachnoid block in both groups

Sensory characteristics	Group-D (Mean ± SD) (N=25)	Group-D (Mean ± SD) (N=25)	p value
Onset (min)	4.882 (± 1.19538)	2.154 (± 1.769)	0.001
Time to T10 sensory level (min)	7.832 (± 1.521162)	4.642 (± 1.368)	0.001
Peak Level (min)	13.84 (± 3.11127)	8.7 (± 5.923607)	0.001
Time to 2 sensory level regression (min)	103.68 (± 23.7596)	51.4 (± 39.2014)	0.001
Time to reach S2 Sensory level (min)	356.4 (± 54.68699)	232.72 (± 55.2536)	0.001

P<0.001 = p value was highly significant

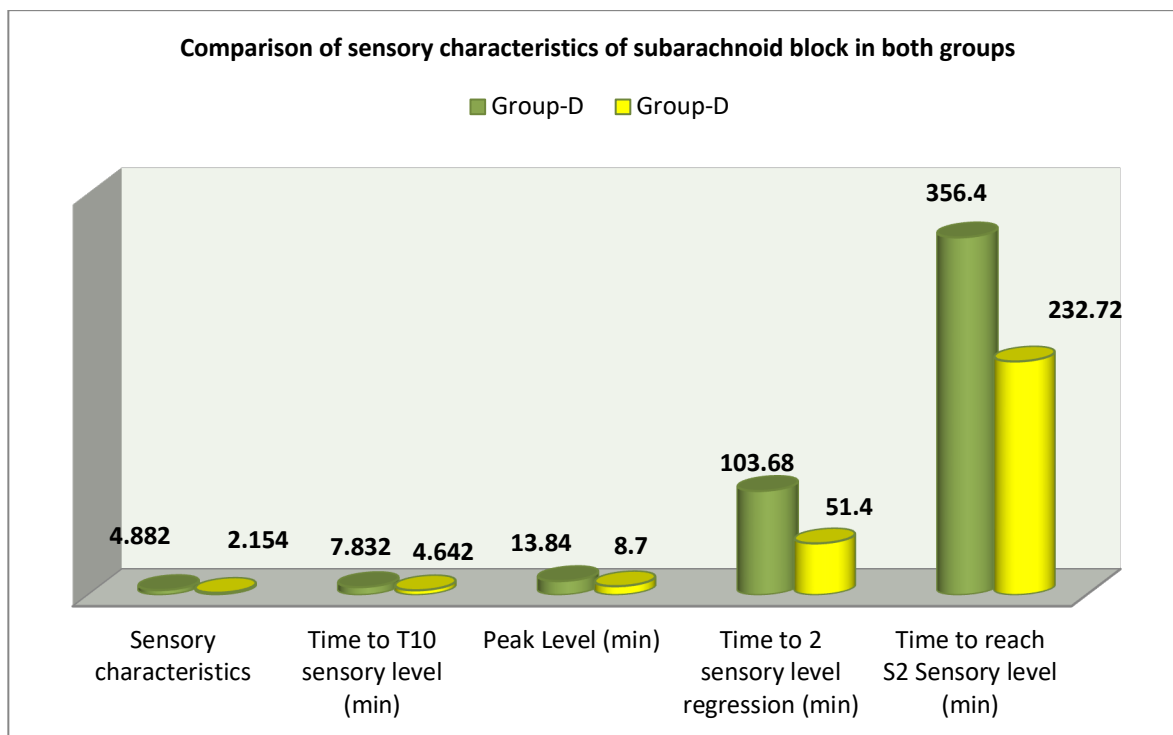


Figure 1: Comparison of sensory characteristics of subarachnoid block in both groups

Table 2: Comparison of duration of effective analgesia amongst study group

Sensory characteristics	Group-D (Mean ± SD)	Group-D (Mean ± SD)	p value
Time to give 1 st dose of post-operative analgesia	361.04 (± 58.512)	249.36 (± 55.772)	0.001

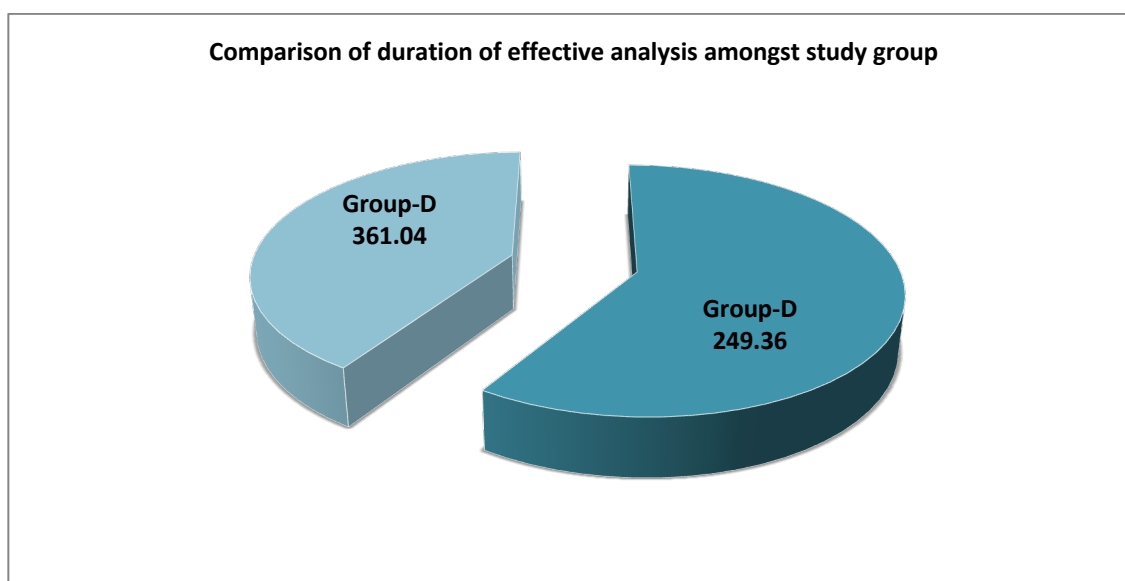


Figure 2: Comparison of duration of effective analgesia amongst study group

Table 3: Comparison of VAS score at different intervals postoperatively amongst the study group

VAS scores	Group D (Mean ±SD)	Group D (Mean ±SD)	P value
VAS @30 min	0	0	0
VAS @60 min	0	0	0
VAS @90 min	0.4 (± 0.2)	0.16 (±0.472)	0.2481
VAS @120 min	0.2 (±0.5)	0.72 (± 0.842)	0.0108
VAS @180 min	0.48 (± 0.714)	1.4 (± 1.040)	0.0007
VAS @210 min	0.68 (± 0.627)	2.44 (± 0.961)	0.001
VAS @240 min	1.16 (± 0.554)	2.6 (± 0.957)	0.001
VAS @270 min	1.6 (± 0.577)	2.12 (± 0.781)	0.0101
VAS @300 min	2.04 (± 0.888)	1.6 (± 0.912)	0.0907

P<0.001 = p value is highly significant

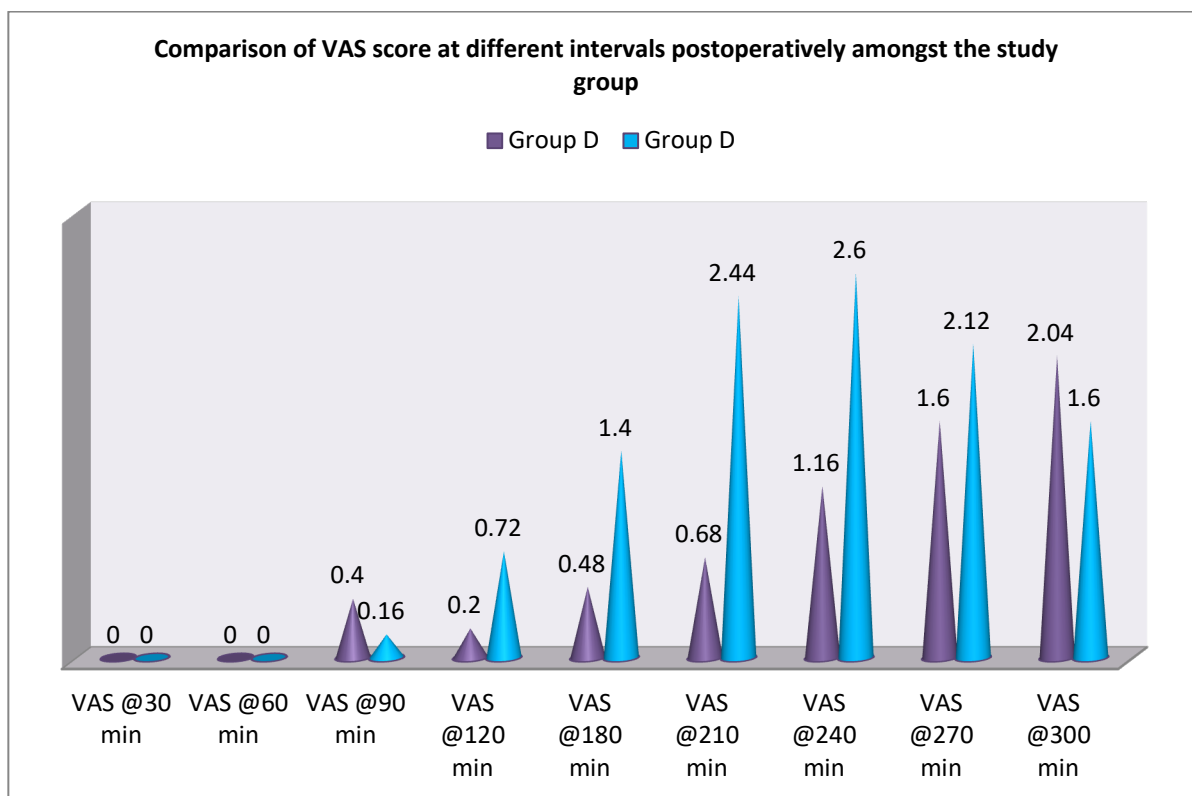


Figure 3: Comparison of VAS score at different intervals postoperatively amongst the study group

Table 4: Comparison of oxygen saturation amongst study group

	Group D	Group F	P value
Baseline	99.28 (± 0.842)	97.96 (± 5.511)	0.242
5 Min	99.36 (± 0.64)	99.12 (± 1.16)	0.371
10 Min	99.28 (± 0.791)	99.12 (± 9.27)	0.514
15 Min	99.28 (± 0.791)	99 (± 1.224)	0.342
20 Min	99.28 (± 0.791)	99.08 (± 1.151)	0.477
25 Min	99.32 (± 0.748)	99 (± 0.816)	0.719
30 Min	99.32 (± 0.748)	99.32 (± 0.9)	0.001
40 Min	99.36 (± 0.757)	99.36 (± 0.7)	0.001
50 Min	99.4 (± 0.764)	99.28 (± 1.167)	0.341
60 Min	99.32 (± 0.748)	99.44 (± 0.711)	0.564
70 Min	99.4 (± 0.767)	99.36 (± 0.860)	0.858
80 Min	99.28 (± 0.737)	99.24 (± 0.830)	0.858
90 Min	99.36 (± 0.7)	99.28 (± 0.792)	0.706
100 Min	99.4 (± 0.707)	99.28 (± 0.792)	0.574
110 Min	99.32 (± 0.627)	99.32 (± 0.690)	1
120 Min	99.2 (± 0.707)	99.28 (± 0.879)	0.860

130 Min	99.2 (\pm 0.645)	99.2 (\pm 0.866)	1
140 Min	99.2 (\pm 0.645)	99.16 (\pm 0.850)	0.852
150 Min	99.2 (\pm 0.663)	99.2 (\pm 0.763)	0.844
180 Min	99.2 (\pm 0.645)	99.12 (\pm 0.781)	0.694
210 Min	99.3 (\pm 0.63)	99.3 (\pm 0.68)	0.888
240 Min	99.2 (\pm 0.645)	98.96 (\pm 0.734)	0.225
300 Min	99.16 (\pm 0.687)	99.96 (\pm 0.735)	0.325
360 Min	99.2 (\pm 5.82)	100.68 (\pm 8.224)	0.374

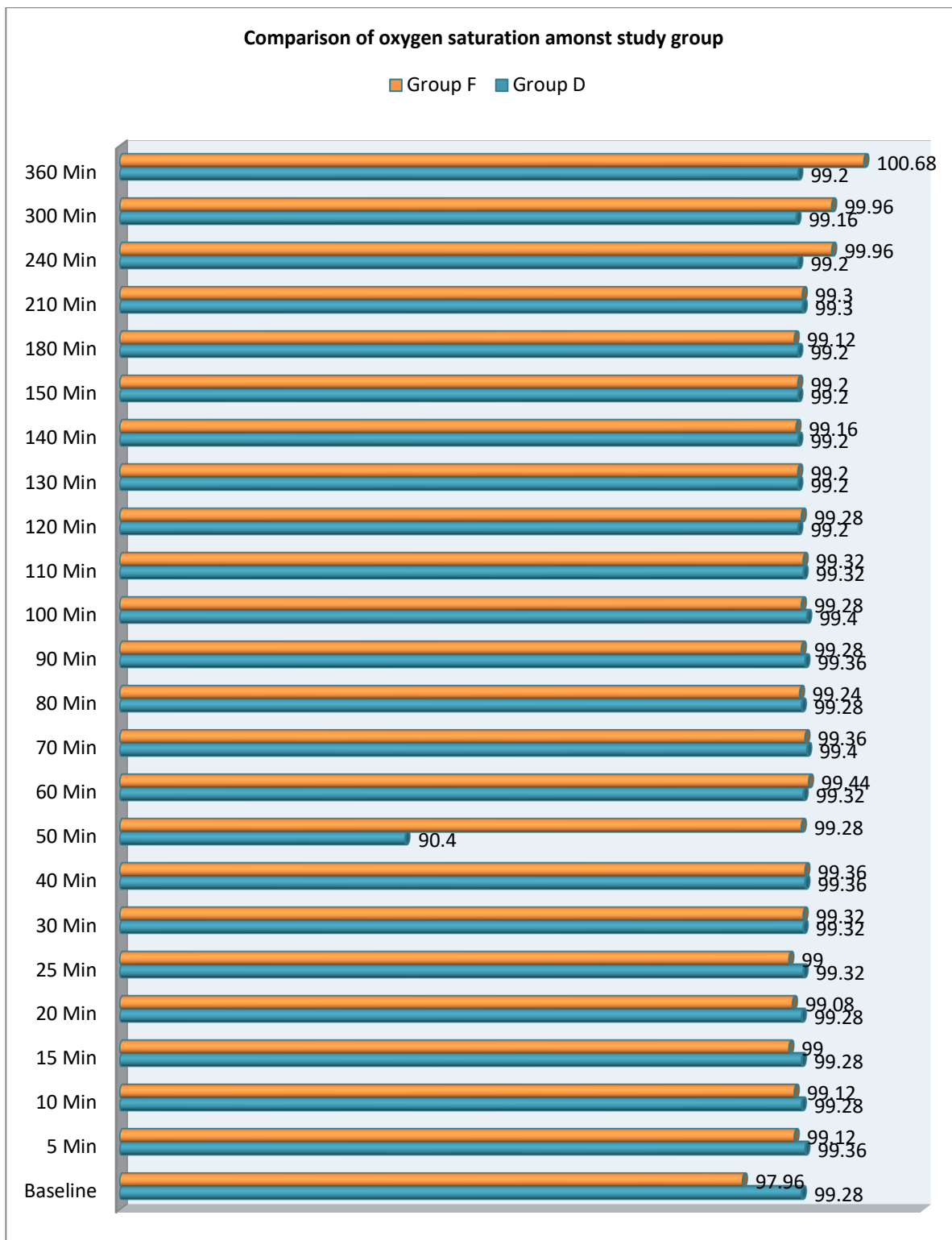


Figure 4: Comparison of oxygen saturation amongst study group

Table 5: Comparison of individual side effects amongst study group

	Group D	Group F	Total
Shivering	10 (40%)	0	10
Pruritus	0	0	0
Nausea	1 (4%)	16 (64%)	17
Vomiting	0	13 (52%)	13
Respiratory depression	0	0	0
Urinary Retention	0	0	0

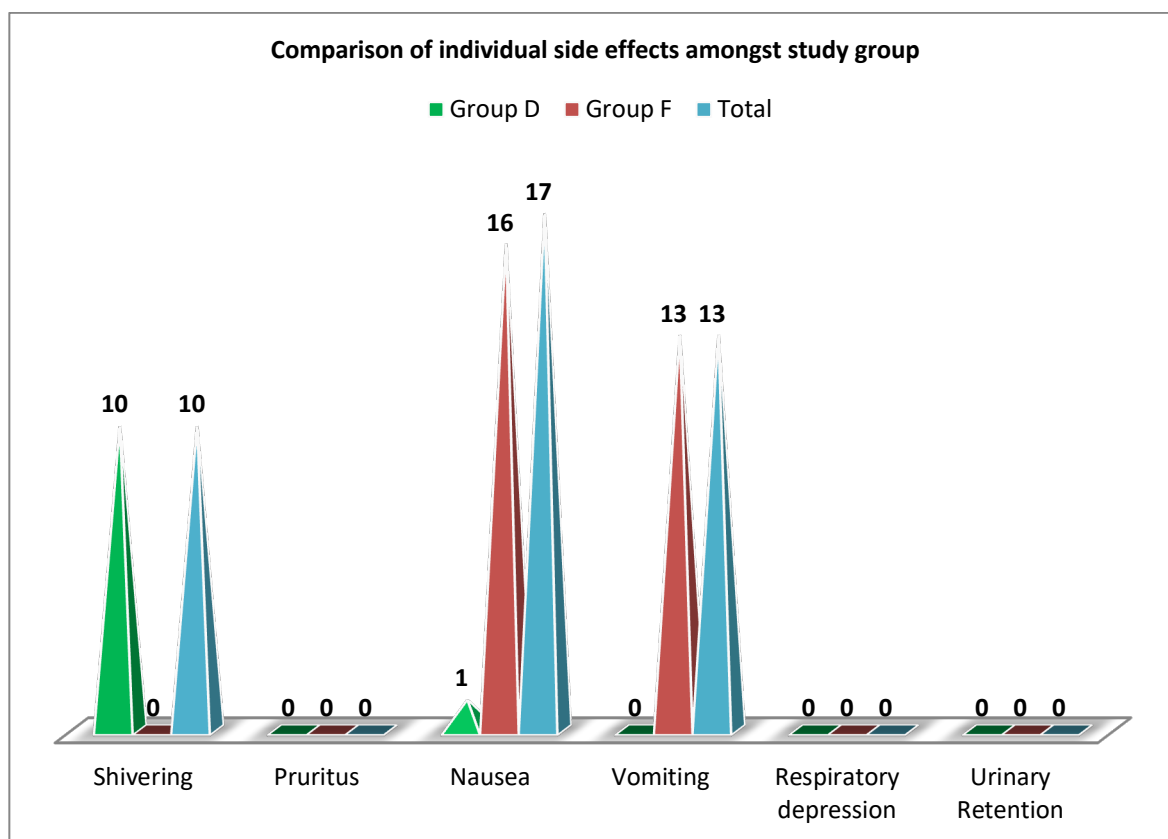


Figure 5: Comparison of individual side effects amongst study group

Discussion

Comparison of intrathecal dexmedetomidine and fentanyl as adjuvants to levobupivacaine for postoperative analgesia in knee surgeries in the Gujarat population was done. In comparison of sensory characteristic of sub-arachnoid block in both groups had a significant p value ($p < 0.001$) (Table 1). The duration of effective analysis in both groups had a significant p value ($p < 0.001$) (table 2). The comparison of VAS scores at different intervals of 120 minutes, 180 minutes, 210 minutes, 240 minutes, and 270 minutes had a significant p value ($p < 0.001$) (Table 3). In the comparison of oxygen saturation at 30 minutes, 40 minutes had a significant p value ($p < 0.001$) (Table 4). In comparison of side effects in both groups, shivering were observed in 10 patient (40%), nausea 1 (4%) in group D, perse nausea were observed in 16 patients (64%) and vomiting in 13patients (52%) in group F (Table 5). These findings are more or less in agreement with previous studies [5,6,7]. Intrathecal

technique helped reduce the dose of local anesthetics, prolonging the duration of action, and achieving more hemodynamic stability [8]. A reduced dosage of local anesthetics can limit the extent of motor block and have fewer side effects; however, a smaller concentration of drug may be insufficient to provide adequate spinal block, hence various adjuvants like opioids, steroids. Alpha-2 agonists, Ketamine, Mgso4, and Neastigmine, have been used with various success rates. Dexmedetomidine is a strong alpha-2 agonist that potentiates the effects of local anesthesia. It has 8 times greater affinity for alpha-2 receptors, with action at the spinal and supraspinal levels as an adjuvant to LA.

The effects of fentanyl and dexmedetomidine as adjuvants to intrathecal isobaric Levobupivacaine on the start and duration of sensory and motor blockade and on hemodynamic parameters were different. When dexmedetomidine was used as an adjuvant instead of fentanyl, the length of the sensory block was longer with a slow onset. In the

present study, motor block was intensified and prolonged in group D as compared to group-F, which is confirmed by previous studies [9]. In analgesic studies, Group-D had more prolongation than Group-F; similar findings were also reported in previous studies (10). Levobupivacaine molecules are more cardiostable than hyperbaric Bupivacaine. It is confirmed that dexmedetomidine has better analgesia than fentanyl with no significant differences in hemodynamics with both drugs.

Summary and Conclusion

In the comparative study of intrathecal Dexmedetomidine and Fentanyl as adjuvants to levobupivacaine for postoperative analgesia in knee surgeries in the Gujarat population, it is noted that Group-F had a faster onset and have faster time to peak onset of sensory blockade but the duration of motor block was shorter in Group-F hence Group-D patients require lesser post-operative rescue analgesia. Side effects like nausea and vomiting were observed in Group-F.

The present study demands that such clinical trials be conducted in a large number of population where the latest techniques are available to combat any type of side effect because the exact pharmacological actions of the anesthetic drugs used in the present study is still unclear.

Limitations of study: Owing to the tertiary locations of the research center, limited number of patients, and covid pandemic we have limited findings and results.

This research work has been approved by the ethical committee of Pramukh Swami Medical College and Shree Krishna Hospital, Karamsad, Gujarat (388325).

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