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Block Characteristics and Hemodynamic Effects of Intrathecal Dexmedetomidine versus Fentanyl with Hyperbaric Bupivacaine in Saddle Block

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Abstract | **Original Research Article**

Background: Spinal anesthesia is widely regarded as the preferred method for lower abdominal surgeries due to its cost-effectiveness, safety, and ability to provide postoperative analgesia while preserving mental clarity and airway reflexes. This study aimed to compare the block characteristics and hemodynamic effects of intrathecal dexmedetomidine versus fentanyl when added to hyperbaric bupivacaine in patients undergoing saddle block for perianal surgeries. ***Methods:*** This quasi-experimental study at the Departments of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh (Oct 2021–Sep 2022), enrolled 64 perianal surgery patients assigned to bupivacaine–fentanyl or bupivacaine–dexmedetomidine groups, assessing block, hemodynamics, analgesia duration, and complications. Data were analyzed with SPSS 23.0 (t-test/Chi-square, $p < 0.05$). ***Results:*** Sixty-four patients received saddle block with bupivacaine 7.5 mg plus fentanyl 15 µg (Group A) or dexmedetomidine 5 µg (Group B). Baseline characteristics were comparable. Sensory (4.82 vs 4.65 min) and motor block onset (12.26 vs 11.58 min) were similar. Hemodynamics remained stable, with minor mid-interval decreases. Group B had longer sensory (292.1 min) and motor block (162.5 min) and prolonged analgesia (278.5 vs 198.7 min, $p = 0.0001$). Hypotension occurred in 2 patients in Group A; no cardiovascular collapse was noted. ***Conclusion:*** Intrathecal dexmedetomidine prolongs sensory and motor block and analgesia more than fentanyl while maintaining stable hemodynamics and minimal complications in saddle block.

Keywords: Block Characteristics, Hemodynamic Effects, Intrathecal Adjuvants.

INTRODUCTION

Spinal anesthesia is widely regarded as the preferred method for lower abdominal surgeries due to its cost-effectiveness and ease of administration [1]. A subarachnoid block represents a relatively safe anesthetic approach and offers the added benefit of postoperative analgesia while maintaining mental clarity and preserving normal airway reflexes [2]. Using a minimal volume of anesthetic, subarachnoid anesthesia is particularly suitable for anoplasty procedures, as it helps maintain stable hemodynamics, particularly in elderly patients, and promotes a smooth, pain-free recovery [3].

Despite these advantages, managing postoperative pain remains challenging because spinal anesthesia with local anesthetics alone has a relatively short duration of action, necessitating early postoperative analgesic intervention [4]. While spinal anesthesia facilitates surgery by preserving spontaneous respiration and relaxing the bowel and abdominal wall [5], these benefits are constrained by the limited duration of local

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anesthetics and potential side effects, such as hypotension and bradycardia [6,7].

In order to enhance block quality, fentanyl is frequently added to hyperbaric bupivacaine, improving both intraoperative anesthesia and early postoperative analgesia [8]. Fentanyl primarily acts as a μ-receptor agonist, achieving a rapid onset within approximately five minutes and maintaining efficacy for three to five hours when administered intrathecally. Its main advantage in selective spinal analgesia is the minimal sympathetic blockade and postural hypotension, which may facilitate early patient ambulation and reduce the risk of cardiovascular collapse or convulsions [9]. Dexmedetomidine, a highly selective α2-adrenergic agonist, has been investigated as a neuraxial adjuvant due to its ability to provide stable hemodynamics, high-quality intraoperative analgesia, and prolonged postoperative pain relief with minimal adverse effects [10,11]. Acting on α2-adrenergic receptors, dexmedetomidine prolongs both sensory and motor block irrespective of the administration route (epidural, caudal, or spinal) and exerts significant opioid-sparing effects when administered intrathecally [12,13]. Both dexmedetomidine and fentanyl have been employed as adjuvants to local anesthetics across various surgeries to enhance analgesic efficacy and extend block duration [14,15].

To date, no study has directly compared the effects of adding dexmedetomidine versus hyperbaric fentanyl to hyperbaric bupivacaine in perianal surgeries, although previous studies have evaluated these agents with isobaric bupivacaine [10,11]. This study aimed to compare the block characteristics and hemodynamic effects of intrathecal dexmedetomidine versus fentanyl when added to hyperbaric bupivacaine in patients undergoing saddle block for perianal surgeries.

Objective

To compare the block characteristics and hemodynamic effects of intrathecal dexmedetomidine versus fentanyl added to hyperbaric bupivacaine in saddle block.

METHODOLOGY & MATERIALS

This quasi-experimental study was conducted at the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from October 2021 to September 2022. Sixty-four patients scheduled for perianal surgery were enrolled based on specific inclusion and exclusion criteria.

Sample Size and Group Allocation

Based on Morgan's table for a population size of 75 with a 5% margin of error, 64 patients were enrolled and alternately assigned into two groups: Group A (n = 32) and Group B (n = 32).

Inclusion Criteria

- Age 40–60 years, either sex
- Surgery duration < 60 minutes
- ASA physical status I or II
- Scheduled for uncomplicated hemorrhoids or anal fistula

Exclusion Criteria

- Patient refusal
- Age <40 or >60 years
- Pregnancy
- Infection at the back
- History of spinal surgery, heart block, cardiac conduction defects, arrhythmias, coagulopathy, neurological or mental disturbances
- Hypersensitivity to local anesthetics, dexmedetomidine, or fentanyl
- Analgesic intake within 24 hours
- Use of alpha-adrenergic antagonists, calcium channel blockers, ACE inhibitors/ARBs, beta-blockers, anti-arrhythmics, or anticoagulants

Interventions

- **Group A:** Hyperbaric bupivacaine 7.5 mg (1.5 mL) with fentanyl 15 μg (30 U)
- **Group B:** Hyperbaric bupivacaine 7.5 mg (1.5 mL) with dexmedetomidine 5 μg (10 U)

Assessment

- **Sensory block:** Time to onset and duration measured using the pinprick method
- **Motor block:** Onset and duration assessed using Bromage scale (Grade I–IV)
- **Hemodynamics:** Heart rate, systolic, diastolic, and mean arterial pressures recorded at specified time points
- **Duration of analgesia:** Time from injection to first request for analgesics
- **Complications:** Hypotension and cardiovascular events monitored

Outcome Measures

- **Primary outcome:** Duration of analgesia
- **Secondary outcomes:** Onset and duration of sensory and motor block, hemodynamic parameters, and complications
- **Demographic variables:** Age, sex, ASA physical status

Ethical Considerations

The study was approved by the BSMMU Institutional Review Board (IRB No. BSMMU/2021/8454, dated 20-09-2021). Written informed consent was obtained from all participants, and confidentiality was maintained. Patients could withdraw at any time, and there were no conflicts of interest.

Statistical Analysis

Data were analyzed using SPSS version 23.0. Continuous variables were expressed as mean ± SD, and

categorical variables as frequencies and percentages. Unpaired Student's t-test was used for continuous variables, and Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic and Baseline Characteristics of Study Participants (n = 64)

Variables		Group A (n=32) n (%)	Group B (n=32) n (%)	Total (n=64) n (%)	Mean ± SD	p-value
Age (years)	40–49	21 (65.6%)	20 (62.5%)	41 (64.1%)	45.3 ± 8.5	0.797
	50–60	11 (34.4%)	12 (37.5%)	23 (35.9%)		
Gender	Female	7 (21.9%)	9 (28.1%)	16 (25.0%)		0.567
	Male	25 (78.1%)	23 (71.9%)	48 (75.0%)		
ASA Status	ASA I	19 (59.4%)	18 (56.3%)	37 (57.8%)		0.803
	ASA II	13 (40.6%)	14 (43.8%)	27 (42.2%)		

The majority of patients were aged 40–49 years (41 patients, 64.1%), followed by those aged 50–60 years (23 patients, 35.9%), with a mean age of 45.3 ± 8.5 years. Males predominated (48 patients, 75.0%) over females (16 patients, 25.0%). Regarding ASA status, 37 patients (57.8%) were classified as ASA I and 27 patients (42.2%) as ASA II. No statistically significant differences were observed between Group A and Group B in age, gender, or ASA status ($p > 0.05$).

Table 2: Time to Onset of Sensory Block (min) in Both Groups (n = 64)

Time (min)	Group A (n=32)	Group B (n=32)	p-value
≤4	18 (56.2%)	23 (71.8%)	
4–8	9 (28.1%)	7 (21.8%)	
>8	5 (15.6%)	2 (6.2%)	
Mean ± SD	4.82 ± 1.4	4.65 ± 1.4	0.628

Sensory block onset occurred within 4 minutes in 41 patients (64.1%), between 4–8 minutes in 16 patients (25.0%), and after 8 minutes in 7 patients (10.9%). The mean time to onset was 4.82 ± 1.4 minutes in Group A and 4.65 ± 1.4 minutes in Group B ($p = 0.628$).

Table 3: Time to Onset of Motor Block (min) in Both Groups (n = 64)

Time (min)	Group A (n=32)	Group B (n=32)	p-value
≤10	6 (18.7%)	7 (21.8%)	
11–15	20 (62.5%)	23 (71.8%)	
>15	6 (18.7%)	2 (6.2%)	
Mean ± SD	12.26 ± 3.96	11.58 ± 3.68	0.968

Motor block onset was ≤10 minutes in 13 patients (20.3%), 11–15 minutes in 43 patients (67.2%), and >15 minutes in 8 patients (12.5%). Mean onset time was 12.26 ± 3.96 minutes in Group A and 11.58 ± 3.68 minutes in Group B ($p = 0.968$).

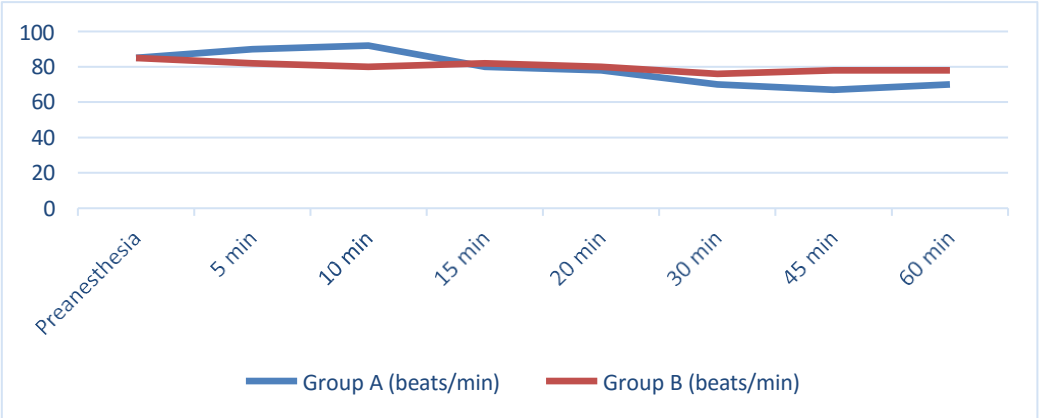

Figure 1: Heart Rate (beats/min) Between Groups Over Time

Pre-anesthesia heart rate was 85 beats/min in both groups. At 5 minutes post-block, heart rate was 90 in Group A and 82 in Group B. At 10 minutes, Group A showed higher heart rate (92 vs. 80). Heart rate then decreased at 15 minutes (80 vs. 82), 20 minutes (78 vs. 80), 30 minutes (70 vs. 76), 45 minutes (67 vs. 78), and 60 minutes (70 vs. 78), with Group A showing a greater decrease.

Table 4: Systolic Blood Pressure (SBP, mmHg) Between Groups Over Time (n = 64)

Time Point	Group A (n=32) Mean ± SD (Range)	Group B (n=32) Mean ± SD (Range)	p value
Pre-anesthesia	121.3 ± 7.2 (110–130)	119.4 ± 7.4 (110–130)	0.301
5 min AS	117.3 ± 5.3 (110–125)	116.3 ± 7.5 (100–125)	0.616
10 min AS	115.3 ± 7.1 (110–125)	115.5 ± 5.1 (110–120)	0.897
15 min AS	115.6 ± 11.2 (110–125)	114.3 ± 4.8 (110–120)	0.548
20 min AS	117.9 ± 4.7 (110–125)	118.3 ± 4.2 (115–125)	0.720
30 min AS	114.6 ± 15.6 (105–125)	115.8 ± 5.0 (110–120)	0.680
45 min AS	117.6 ± 11.6 (105–125)	119.3 ± 8.2 (110–120)	0.501
60 min AS	118.3 ± 5.14 (110–125)	117.2 ± 5.8 (110–120)	0.425

Mean SBP ranged from 114.6–118.3 mmHg in Group A and 115.8–119.3 mmHg in Group B. Pre-anesthesia SBP was 121.3 ± 7.2 mmHg in Group A and 119.4 ± 7.4 mmHg in Group B ($p = 0.301$). No statistically significant differences were observed at any time point ($p > 0.05$).

Table 5: Diastolic Blood Pressure (DBP, mmHg) Between Groups Over Time (n = 64)

Time Point	Group A (n=32) Mean ± SD (Range)	Group B (n=32) Mean ± SD (Range)	p value
Pre-anesthesia	79.6 ± 6.0 (75–90)	78.2 ± 9.4 (70–90)	0.480
5 min AS	63.9 ± 5.2 (60–70)	61.2 ± 9.6 (55–80)	0.213
10 min AS	69.6 ± 5.6 (65–75)	68.5 ± 9.5 (60–75)	0.475
15 min AS	67.6 ± 7.4 (65–75)	61.5 ± 9.7 (65–80)	0.013
20 min AS	68.5 ± 7.1 (65–75)	62.9 ± 9.7 (60–80)	0.010
30 min AS	72.5 ± 6.8 (65–80)	67.9 ± 8.7 (60–80)	0.039
45 min AS	69.5 ± 5.6 (65–80)	65.9 ± 6.3 (60–75)	0.018
60 min AS	73.7 ± 9.8 (70–85)	70.9 ± 8.3 (65–80)	0.222

Mean DBP ranged from 63.9–73.7 mmHg in Group A and 61.2–70.9 mmHg in Group B. Pre-anesthesia DBP was 79.6 ± 6.0 mmHg in Group A and 78.2 ± 9.4 mmHg in Group B ($p = 0.480$). Significant reductions were noted in Group B at 15, 20, 30, and 45 minutes post-block ($p < 0.05$).

Table 6: Mean Arterial Pressure (MAP, mmHg) Between Groups Over Time (n = 64)

Time Point	Group A (n=32) Mean ± SD	Group B (n=32) Mean ± SD	p value
Pre-anesthesia	69.60 ± 11.6	68.93 ± 9.1	0.883
5 min AS	70.45 ± 8.2	67.90 ± 9.5	0.086
10 min AS	75.40 ± 7.9	74.25 ± 10.2	0.615
15 min AS	76.92 ± 8.1	69.18 ± 9.5	0.0001
20 min AS	76.31 ± 8.6	68.73 ± 9.1	0.0001
30 min AS	71.57 ± 10.2	65.18 ± 7.5	0.005
45 min AS	71.05 ± 9.3	68.46 ± 11.4	0.435
60 min AS	69.55 ± 6.8	66.52 ± 7.1	0.086

MAP ranged from 69.6–76.92 mmHg in Group A and 66.52–74.25 mmHg in Group B. Pre-anesthesia MAP was 69.60 ± 11.6 mmHg in Group A and 68.93 ± 9.1 mmHg in Group B ($p = 0.883$). Significant differences were observed at 15, 20, and 30 minutes post-block ($p < 0.05$).

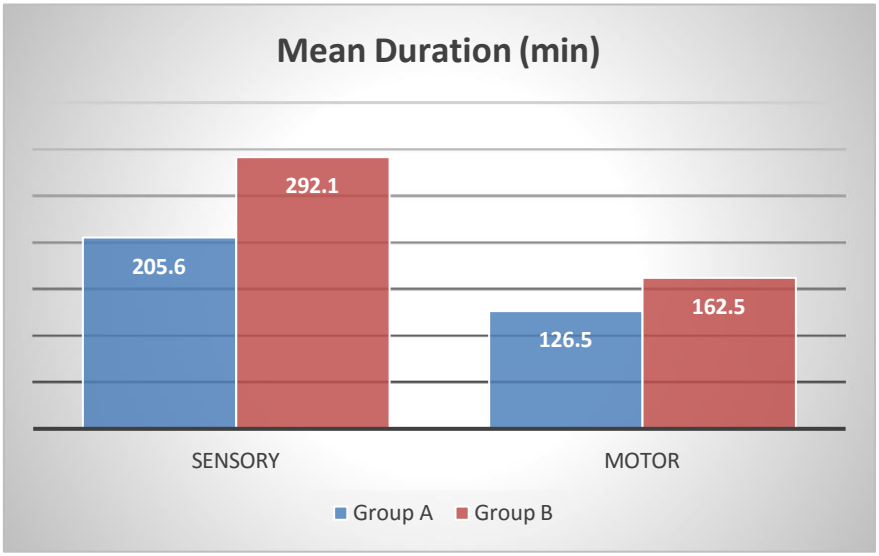

Figure 2: Sensory and Motor Block Duration (minutes) in Both Groups

Mean sensory block duration was 205.6 minutes in Group A and 292.1 minutes in Group B. Mean motor block duration was 126.5 minutes in Group A and 162.5 minutes in Group B.

Table 7: Duration of Analgesia (minutes) Between Groups (n = 64)

Parameter	Group A (n=32) Mean ± SD	Group B (n=32) Mean ± SD	p value
Duration of Analgesia (minutes)	198.7 ± 25.2	278.5 ± 16.2	0.0001

Mean duration of analgesia was 198.7 ± 25.2 minutes in Group A and 278.5 ± 16.2 minutes in Group B (p = 0.0001).

Table 8: Complications in Both Groups (n = 64)

Complication	Group A (n=32) n (%)	Group B (n=32) n (%)
Hypotension	2 (6.3%)	0 (0%)
Cardiovascular Collapse	0 (0%)	0 (0%)

Hypotension occurred in 2 patients (6.3%) in Group A and none in Group B. Cardiovascular collapse occurred in 0 patients in both groups.

DISCUSSION

Perianal surgeries often require effective postoperative analgesia to ensure patient comfort and early mobilization. Saddle block with hyperbaric bupivacaine provides safe, targeted anesthesia while preserving mental clarity and airway reflexes. This study found that adding intrathecal dexmedetomidine significantly prolonged sensory and motor block and postoperative analgesia compared to fentanyl, without clinically significant hemodynamic changes, highlighting its benefit as an adjuvant in perianal surgeries.

In this study, the demographic and baseline characteristics of participants were comparable between Group A and Group B. The majority of patients were aged 40–49 years (41 patients, 64.1%), with the remaining 23 patients (35.9%) aged 50–60 years, and the mean age was 45.3 ± 8.5 years. Males predominated in both groups (48 patients, 75.0%), and ASA I and II patients were 37 (57.8%) and 27 (42.2%), respectively. No statistically significant differences were observed between groups in age, gender, or ASA status ($p > 0.05$), indicating balanced baseline characteristics. These results align with Zengin *et al.,* [16], who reported no significant differences in demographic parameters between low- and higher-dose hyperbaric bupivacaine saddle block groups, and with Jangi *et al.,* [17], who found comparable age and sex distribution in patients receiving intrathecal bupivacaine with or without fentanyl, supporting the comparability of study groups for subsequent block and hemodynamic analyses.

The onset of sensory block occurred within 4 minutes in 41 patients (64.1%), between 4–8 minutes in 16 patients (25.0%), and after 8 minutes in 7 patients (10.9%), with mean onset times of 4.82 ± 1.4 minutes in Group A and 4.65 ± 1.4 minutes in Group B (p = 0.628). These findings are consistent with Gautam *et al.,* [18], who observed slightly earlier sensory block onset with intrathecal dexmedetomidine, while peak sensory block and magnitude of motor block were comparable between groups, supporting our finding of non-significant differences in sensory block onset timing between dexmedetomidine and fentanyl.

The onset of motor block was ≤10 minutes in 13 patients (20.3%), 11–15 minutes in 43 patients (67.2%), and >15 minutes in 8 patients (12.5%), with mean onset times of 12.26 ± 3.96 minutes in Group A and 11.58 ± 3.68 minutes in Group B ($p = 0.968$). These results align with Rahimzadeh *et al.,* [19], who reported no significant difference in time to achieve Bromage 3 motor block between dexmedetomidine and fentanyl, and with Gupta *et al.,* [20], who similarly observed comparable motor block onset despite prolonged motor block duration with dexmedetomidine. This confirms that the choice of adjuvant does not significantly affect the time to achieve motor block in saddle spinal anesthesia.

Heart rate (HR) monitoring revealed a pre-anesthesia HR of 85 beats/min in both groups. Group A showed slight increases at 5 and 10 minutes post-block (90 and 92 beats/min) compared with Group B (82 and 80 beats/min), followed by gradual declines in both groups over 15, 20, 30, 45, and 60 minutes, with a more pronounced decrease in Group A. These findings are consistent with Seyam *et al.,* [21], who reported stable HR trends with continuous monitoring after saddle block using dexmedetomidine or fentanyl, and with Afsar *et al.,* [22], who noted modest HR changes that stabilized after initial fluctuations during saddle block, supporting the hemodynamic stability observed in our study.

Systolic blood pressure (SBP) remained stable throughout the procedure, with Group A ranging from 114.6 to 118.3 mmHg and Group B from 115.8 to 119.3 mmHg, and no statistically significant differences at any time point ($p > 0.05$). This is in agreement with Seyam *et al.,* [21], who observed stable SBP in patients receiving either adjuvant, confirming comparable hemodynamic stability between dexmedetomidine and fentanyl.

Diastolic blood pressure (DBP) showed a modest decline in both groups, with significant reductions at 15, 20, 30, and 45 minutes, particularly in Group B, but pre-anesthesia and later time points were comparable. Khan *et al.,* [23] similarly reported slight decreases in SBP, DBP, and MAP with both adjuvants, without significant intergroup differences, corroborating our observation that transient mid-interval DBP reductions did not compromise overall hemodynamic stability.

Mean arterial pressure (MAP) values were comparable at baseline (69.60 ± 11.6 vs. 68.93 ± 9.1 mmHg) and remained generally stable, with significant differences only at 15, 20, and 30 minutes post-block, where Group A showed higher values. These findings mirror those of Saiyad *et al.,* [24] and Bhagyalakshmi *et al.,* [25], who reported overall stable MAP trends with minor variations at individual time points, further supporting the hemodynamic safety of both adjuvants in saddle block.

The mean sensory block duration was 205.6 minutes in Group A and 292.1 minutes in Group B, while mean motor block duration was 126.5 minutes in Group A and 162.5 minutes in Group B, indicating that intrathecal dexmedetomidine prolonged both sensory and motor block compared to fentanyl. Gupta *et al.,* [20] similarly reported significantly longer sensory regression and motor block durations with dexmedetomidine, confirming its efficacy in extending saddle block anesthesia.

Postoperative analgesia was significantly prolonged with dexmedetomidine (278.5 ± 16.2 minutes) compared to fentanyl (198.7 ± 25.2 minutes, $p = 0.0001$), consistent with Gautam *et al.,* [18], who observed markedly extended analgesia with intrathecal dexmedetomidine. These results underscore the adjuvant role of dexmedetomidine in enhancing postoperative pain control.

Finally, complications were minimal, with hypotension in 2 patients (6.3%) in Group A and none in Group B, and no cardiovascular collapse in either group. Sun *et al.,* [26] reported similar low incidences of hemodynamic complications with dexmedetomidine and fentanyl, supporting the safety of both adjuvants in saddle block.

Limitations of the study

The study had a few limitations:

- Assessment of sensory block in the perianal region posed challenges due to privacy concerns.
- Potential for observer or patient bias in reporting outcomes.

CONCLUSION

Saddle block with hyperbaric bupivacaine provides effective anesthesia for lower body procedures. In this study, adding dexmedetomidine resulted in longer sensory and motor block durations and extended analgesia compared to fentanyl, while both groups maintained stable hemodynamics and experienced minimal complications, demonstrating the safety and efficacy of intrathecal adjuvants in enhancing block quality and postoperative pain control.

REFERENCES

1. Elia N, Culebras X, Mazza C, Schiffer E, Tramèr MR. Clonidine as an adjuvant to intrathecal local anesthetics for surgery: systematic review of randomized trials. Regional Anesthesia & Pain Medicine. 2008 Feb 1;33(2):159-67.
2. Cousins MJ. Intrathecal and epidural administration of opioids. Anesthesiology. 1984; 61:276-310.
3. Stewart J, Gasanova I, Joshi GP. Spinal anesthesia for ambulatory surgery: current controversies and concerns. Current Opinion in Anesthesiology. 2020 Dec 1;33(6):746-52.

4. Boussofara M, Carlès M, Raucoules-Aimé M, Sellam MR, Horn JL. Effects of intrathecal midazolam on postoperative analgesia when added to a bupivacaine-clonidine mixture. Regional Anesthesia & Pain Medicine. 2006 Nov 1;31(6):501-5.
5. Brown DL. Spinal, epidural, and caudal anesthesia. Miller's anesthesia. 2010:1611-38.
6. Gupta M, Shailaja S, Hegde KS. Comparison of intrathecal dexmedetomidine with buprenorphine as adjuvant to bupivacaine in spinal asnaesthesia. Journal of clinical and diagnostic research: JCDR. 2014 Feb 3;8(2):114.
7. Abdelhamid SA, El-Lakany MH. Intrathecal dexmedetomidine: Useful or not. J Anesth Clin Res. 2013;4(9):351.
8. Hunt CO, Naulty JS, Bader AM, Hauch MA, Vartikar JV, Datta S, Hertwig LM, Ostheimer GW. Perioperative analgesia with subarachnoid fentanyl-bupivacaine for cesarean delivery. Anesthesiology. 1989 Oct 1;71(4):535-40.
9. Schnaider TB, Vieira AM, Brandão AC, Lobo MV. Intraoperative analgesic effect of epidural ketamine, clonidine or dexmedetomidine for upper abdominal surgery. Revista brasileira de anestesiologia. 2005; 55:525-31.
10. Almustafa M. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. PubMed. 2009 Mar 1.
11. Al-Ghanem SM, Massad IM, Al-Mustafa MM, Al-Zaben KR, Qudaisat IY, Qatawneh AM, Abu-Ali HM. Effect of adding dexmedetomidine versus fentanyl to intrathecal bupivacaine on spinal block characteristics in gynecological procedures: A double-blind controlled study. American journal of applied sciences. 2009;6(5):882.
12. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, Bulbul M, Baraka AS. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta anaesthesiologica scandinavica. 2006 Feb;50(2):222-7.
13. Bekker A, Sturaitis MK. Dexmedetomidine for neurological surgery. Operative Neurosurgery. 2005 Jul 1;57(1):1-0.
14. Mohamed T, Susheela I, Balakrishnan BP, Kaniyil S. Dexmedetomidine as adjuvant to lower doses of intrathecal bupivacaine for lower limb orthopedic surgeries. Anesthesia Essays and Researches. 2017 Jul 1;11(3):681-5.
15. Farooq N, Singh RB, Sarkar A, Rasheed MA, Choubey S. To evaluate the efficacy of fentanyl and dexmedetomidine as adjuvant to ropivacaine in brachial plexus block: a double-blind, prospective, randomized study. Anesthesia Essays and Researches. 2017 Jul 1;11(3):730-9.
16. Zengin EN, Yalnız KY, Başkan S, Öztürk L. Comparison of Different Local Anesthetic Volumes for Saddle Block Anesthesia in Ambulatory Surgery: A Prospective Randomized Trial. Cureus. 2023 Jun 27;15(6): e41063.
17. Jangi KG, Kuldeep A, Raiger LK, Sharma S. Evaluation of low dose hyperbaric bupivacaine with or without fentanyl in perianal surgeries: A prospective randomized double-blind trial. Ind J Clin Anaesth [Internet]. 2021;8(1):38–44.
18. Gautam B, Lama SM, Sharma M. Effects of Adding Intrathecal Dexmedetomidine to Hyperbaric Bupivacaine for Saddle Spinal Block in Adults Undergoing Peri-anal Surgeries. J Nepal Health Res Counc. 2018 Mar 13;16(1):43-48.
19. Rahimzadeh P, Faiz SH, Imani F, Derakhshan P, Amniati S. Comparative addition of dexmedetomidine and fentanyl to intrathecal bupivacaine in orthopedic procedure in lower limbs. BMC anesthesiology. 2018 Jun 6;18(1):62.
20. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A Comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to Bupivacaine. J Anaesthesiol Clin Pharmacol. 2011 Jul;27(3):339-43.
21. Seyam SH, Abdelgawad IM, Abdelhalim MA. Dexmedetomidine versus fentanyl as an adjuvant to bupivacaine in saddle anesthesia for anoplasty: a correlative randomized double-blinded trial. Anaesthesia, Pain & Intensive Care. 2024 Apr 17;28(2):302-9.
22. Afsar MI, Shahzad S, Tariq M. Change in Hemodynamics with Saddle versus Spinal Block in Patients Undergoing Elective Transurethral Resection of Prostate for Benign Prostate Hyperplasia. Age (years).;56(12.01):62-35.
23. Khan AL, Singh RB, Tripathi RK, Choubey S. A comparative study between intrathecal dexmedetomidine and fentanyl as adjuvant to intrathecal bupivacaine in lower abdominal surgeries: A randomized trial. Anesthesia Essays and Researches. 2015 May 1;9(2):139-48.
24. Saiyad JH, Patel SK, Patel US. A Comparison of Dexmedetomidine and Fentanyl as an Adjuvant to Intrathecal Hyperbaric Bupivacaine in Elective Lower Limb Surgeries. National Journal of Medical Research. 2021 Oct 1;11(4).
25. Bhagyalakshmi M, Dharuni Priya Krishnappa Ramdass D, Roopa Rani K. A comparative study of intrathecal dexmedetomidine 10 mcg and fentanyl 25 mcg as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia with a 0.5 ml normal saline control group. SEEJPH. 2025 Jan 5;26(S1):3826.
26. Sun S, Wang J, Bao N, Chen Y, Wang J. Comparison of dexmedetomidine and fentanyl as local anesthetic adjuvants in spinal anesthesia: a systematic review and meta-analysis of randomized controlled trials. Drug Des Devel Ther. 2017 Dec 1; 11:3413-3424.