Section: Anaesthesia

Original Research Article

COMPARISON OF THE EFFICACY BETWEEN INTRATHECAL DEXMEDETOMIDINE AND INTRATHECAL MORPHINE IN PATIENTS UNDERGOING LOWER ABDOMINAL SURGERIES UNDER GENERAL ANAESTHESIA

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ABSTRACT

Background: General Anaesthesia is the standard anaesthetic technique for abdominal procedures. Adequate pain control in postoperative period allows the patient for early ambulation and discharge from hospital. Postoperative pain management is quite a challenging task for anaesthesiologist even with the multimodal approach. **Objectives:** The primary objective was to evaluate the duration of analgesia between intrathecal dexmedetomidine and intrathecal morphine. The secondary objectives were to assess the, incidence of postoperative nausea, vomiting, pruritis, shivering and total dose of opioid consumption between intrathecal dexmedetomidine and intrathecal morphine.
Material and Methods: The study was a prospective, randomized, double blinded clinical trial conducted on 60 patients belonging to American Society of Anaesthesiologists (ASA) status I and II undergoing lower abdominal surgeries under general anaesthesia at Naruvi Hospitals, Vellore. After approval from Institutional Ethics Committee, informed and written consent were obtained from participating study patients. They were randomly divided into two groups of 30 by computer generated randomization table. Patients in group A received 5 mcg of intrathecal dexmedetomidine with 1 ml of 0.25% isobaric bupivacaine prior to administration of general anaesthesia and Group B received 100 mcg of intrathecal morphine with 1 ml of 0.25% isobaric bupivacaine prior to administration of general anaesthesia. These patients were monitored postoperatively for first 24 hours in the ward.
Results: The two groups were found to be similar with respect to duration of analgesia, incidence of postoperative nausea, vomiting, pruritus, shivering and total dose of opioid consumption. No adverse effects were noted in either group.
Conclusion: Intrathecal dexmedetomidine and intrathecal morphine provided similar postoperative analgesic efficacy when used as adjuvants in lower abdominal surgeries under general anaesthesia. Both drugs demonstrated comparable safety profiles, with clinically no significant differences in postoperative nausea, vomiting, pruritus and shivering.
Keywords: Intrathecal dexmedetomidine, Intrathecal morphine, Postoperative analgesia, Lower abdominal surgeries.

INTRODUCTION

General Anaesthesia is the standard anaesthetic technique for abdominal procedures.[1] Despite progress in pharmacological therapies and advanced drug delivery methods, studies reveal that about 85% of patients continued to have uncontrolled postoperative pain.[2] It is the duty of an anaesthesiologist to ensure a postoperative period that is both safe and comfortable for the patient, which can be achieved through multimodal analgesic approach.[3] Effective management of postoperative pain is essential in the care of patients as pain can alter a patient's endocrine response by elevating catecholamine and cortisol levels, potentially intensifying autonomic reflexes. This can lead to hypertensive crisis or vagal syndromes, which may cause serious complications. Currently, the patients undergoing lower abdominal surgeries under GA receive IV opioids and non-opioids for pain control. However, such patients experience inadequate pain control necessitating higher doses of IV opioids leading to increased incidence of PONV, pruritus, respiratory discomfort, constipation and tolerance all of which hinders the enhanced recovery. Repeated use of opioids may lead to opioid tolerance necessitating larger doses of the same drug, overpowering desire to use the drug and patient dissatisfaction with smaller doses which may eventually lead to opioid use disorder.[4]

Morphine is considered as the prototype of opioid group of drugs and acts as an agonist at mu and kappa opioid receptors. When given intrathecally, it produces analgesia by acting at synapses and inhibits excitatory neurotransmitter thereby decreasing the pain response. Compared with erector spinae plane block, 0.3 mg intrathecal morphine was superior in terms of postoperative pain relief, lower pain scores at rest and lower tramadol consumption in patients undergoing total abdominal hysterectomies under GA. IT morphine is hydrophilic in nature and therefore diffuses slowly in the CSF, leading to long-lasting effect than IV route. The analgesic effect of intrathecal morphine lasts for 24 to 48 hours.[5] However, literature comparing intrathecal morphine with intrathecal dexmedetomidine specifically in lower abdominal surgeries under general anaesthesia is limited. Hence, we designed to evaluate the efficacy of intrathecal morphine 100 mcg to intrathecal dexmedetomidine 5 mcg in patients undergoing lower abdominal surgeries under GA.

MATERIALS AND METHODS

This study was conducted at Naruvi Hospitals, Vellore, Tamil Nadu, India in accordance with guidelines of institutional ethical review board. This study was conducted in 60 patients posted for elective lower abdominal surgeries under GA. This study was done as a prospective, randomized, double-blinded clinical trial. This study was conducted from April 2024 to April 2025, after obtaining Scientific and Ethical committee approval.

Inclusion Criteria

- Patients aged 18 to 65 years scheduled for lower abdominal surgeries under GA
- Patients belonging to ASA physical status class I and II (i.e., those with no comorbidities or with well-controlled comorbid conditions).

Exclusion Criteria

- ASA class III and above (poorly controlled comorbidities or multisystem involvement).
- Age below 18 years or above 65 years.
- Severe cardiac dysfunction.
- Chronic use of opioids or alpha-2 agonists.
- Known allergy to study drugs.
- Pregnant or breastfeeding women.
- Coagulopathies.
- Patients unwilling for spinal anaesthesia or for study participation.
- Patients undergoing LSCS.
- Cognitive or psychiatric disturbances.
- Conduction blocks.
- Uncontrolled hypertension.
- Patients requiring postoperative ventilatory support

A sample size of 30 patients per group was calculated to achieve 90% power with a 5% level of significance. Thirty patients were enrolled in each group to compensate for possible dropouts.

Intervention Groups

Two groups were formed based on randomization:

Group A received 5 mcg of IT dexmedetomidine with 1 ml of 0.25% isobaric bupivacaine prior to induction of GA. Group B received 100 mcg of IT morphine with 1 ml of 0.25% isobaric bupivacaine prior to induction of GA. Patients were randomized into two groups using a computer-generated randomization code to ensure equal allocation and to minimize selection bias. The study followed a double-blind design.

Methodology

All patients scheduled for elective lower abdominal surgery were assessed a day before the procedure and optimized preoperatively. Patients were adequately fasted as per standard fasting guidelines and premedicated with tablet alprazolam 0.25 mg the night before surgery and tablet pantoprazole 40 mg on the morning of surgery. They were informed about the study procedure and written informed consent was obtained. In the operating room, standard monitors were applied, including pulse oximetry, non-invasive blood pressure cuff, electrocardiogram and temperature probe. An 18/20-gauge IV line was secured and Ringer's lactate infusion at 10 ml/kg/h was started. Under strict aseptic precautions:

Group A received 5 mcg of IT dexmedetomidine with 1 ml of 0.25% isobaric bupivacaine prior to induction of GA using a narrow-gauge spinal needle at L2-L3/L3-L4 interspace. Group B received 100 mcg of IT morphine with 1 ml of 0.25% isobaric bupivacaine

prior to induction of GA using a narrow-gauge spinal needle at L2-L3/L3-L4 interspace.

In the post-anaesthesia care unit, patients received injection ketorolac 30 mg in 100 ml normal saline. Postoperative analgesia was maintained with IV paracetamol 15 mg/kg every 8 hours and ketorolac 30 mg twice daily for 24 hours, along with IV pantoprazole 40 mg once daily and ondansetron 4 mg twice daily. Pain was assessed using the NPRS for the first 24 hours postoperatively. Patients were also evaluated for PONV, shivering and pruritus during the same period. When pain scores were >3, rescue analgesia was provided with IV tramadol 50 mg in 100 ml saline over 30 minutes every 6 hours (maximum 200 mg/day) until the pain scores become <3 and the total tramadol usage was documented.

When pruritus scores were >2, patients were treated with IV chlorpheniramine maleate 2 ml in 100 ml saline over 30 minutes. When PONV scores were >2, IV ondansetron 0.1 mg/kg every 6 hours was administered until the score decreased below 2. The primary outcome was to evaluate the duration of analgesia between IT dexmedetomidine and IT morphine in the immediate postoperative period. The secondary outcomes were to assess: The incidence of PONV, pruritus and shivering within the first 24 hours. The total opioid consumption in the postoperative period.

Data Analysis

The data was collected using the proforma (enclosed), entered and analysed with the SPSS software version 24.0. Descriptive analysis of study variables was expressed as proportion, mean, median, and standard deviation. The chi-square test was used for non-parametric variables. The confidence interval was set at 95%. A p-value less than 0.05 ($p<0.05$) was considered to be statistically significant. Data has also been represented using appropriate pictorial representations generated using MS Excel.

Authorization to carry out the study was obtained from the Institutional Ethics Committee. Informed written consent was obtained from the study participants/primary caregivers after explaining the risks and benefits in a language they understood

RESULTS

Table 1: ASA distribution

Variable		Group A (IT dexmedetomidine)	Group B (IT morphine)	Total	Chi-square	P-value
ASA	I	8 (26.7)	9 (30.0)	17	0.082	0.774
	II	22 (73.3)	21 (70.0)	43		

Distribution of ASA grades was comparable between both groups indicating no significant difference.

Table 2: Duration of surgery

Variable	Group		t-value	P-value
	A (IT dexmedetomidine)	B (IT morphine)		
	Mean±SD	Mean±SD		
Duration of surgery (mins)	102.17± 22.69	104.67±40.66	-0.294	0.77

The mean duration of surgery was 102.17 ± 22.69 mins in the dexmedetomidine group and 104.67 ± 40.66 mins in the morphine group. The difference between the two groups were not statistically significant.

Table 3: Haemodynamic changes

Variables		Group A (IT dexmedetomidine)	Group B (IT morphine)	Total	Chi-square	P-value
Hypotension	No	13 (43.3)	18 (60.0)	31	1.669	0.196
	Yes	17 (56.7)	12 (40.0)	29		
Hypertension	No	30 (100)	28 (93.3)	58	2.069	0.15
	Yes	0	2 (6.7)	2		
Bradycardia	No	21 (70.0)	25 (83.3)	46	1.491	0.222
	Yes	9 (30.0)	5 (16.7)	14		
Tachycardia	No	30 (100)	28 (93.3)	58	2.069	0.15
	Yes	0	2 (6.7)	2		

Hypotension was observed in 17 patients (56.7%) in the dexmedetomidine cohort and 12 patients (40.0%) in the morphine cohort. Hypertension occurred infrequently, observed in only 2 patients (6.7%) within the morphine cohort (p = 0.15). Bradycardia was observed in 9 patients (30%) receiving dexmedetomidine and 5 patients (16.7%) receiving morphine (p = 0.222). Tachycardia occurred in 2 patients (6.7%), exclusively within the morphine group (p = 0.15). None of the haemodynamic variations attained statistical significance, suggesting comparable safety profiles for both medications.

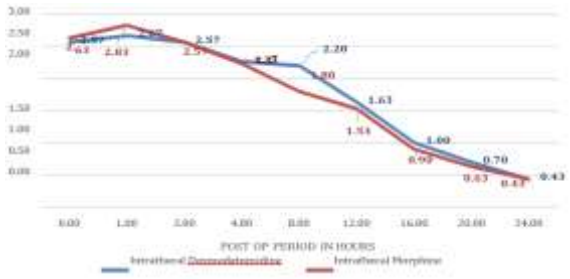

Figure 1: Line graph comparing pain score between group A (IT dexmedetomidine) and group B (IT morphine)

Pain scores were comparable between IT dexmedetomidine and IT morphine at baseline and during the early postoperative period (0–2 hours). Morphine at 4–8 hours, had lower mean pain scores than dexmedetomidine but results were not significant. From 12 to 20 hours, both groups maintained similarly low pain scores, reflecting effective and sustained analgesia. By 24 hours, pain scores remained minimal in both the groups.

Table 4: Duration of analgesia

Variable	Group		t-value	P-value
	A (IT dexmedetomidine)	AB (IT morphine)		
	Mean±SD	Mean±SD		
Duration of analgesia (hrs)	20.30± 8.47	20.87±8.13	-0.264	0.792

The mean duration of analgesia was 20.3 ± 8.47 hrs in the dexmedetomidine group and 20.87 ± 8.13 hrs in the morphine group, with no significant difference seen.

Table 5: PONV score

PONV score at follow up in hours	Group	Mean	S.D	P value
0	A (IT dexmedetomidine)	0.13	0.43	0.249
	B (IT morphine)	0.03	0.18	
1	A (IT dexmedetomidine)	0.20	0.55	0.233
	B (IT morphine)	0.07	0.24	
2	A (IT dexmedetomidine)	0.13	0.43	0.471
	B (IT morphine)	0.07	0.25	
4	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	
8	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	
12	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	
16	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	
20	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	
24	A (IT dexmedetomidine)	0	0	1
	B (IT morphine)	0	0	

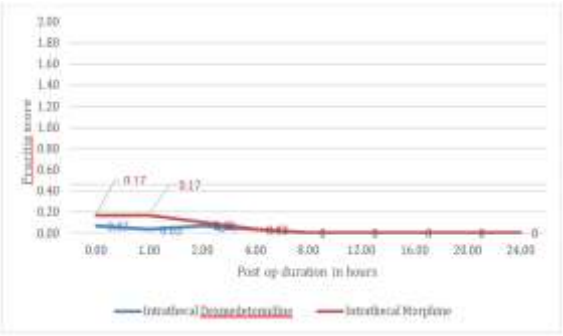

Figure 2: Line graph comparing pruritis score between group A (IT dexmedetomidine) and group B (IT morphine)

On comparing pruritus scores, the mean values between the two groups were not significantly different, suggesting that both the drugs have a similar effect on pruritus.

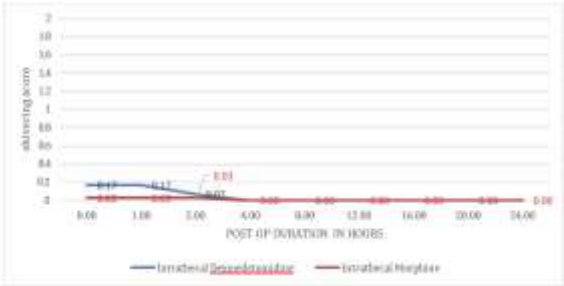

Figure 3: Line graph comparing shivering score between group A (IT dexmedetomidine) and group B (IT morphine)

On comparing shivering scores, the mean values between the two groups were not significantly different, suggesting that both drugs have a similar effect on shivering.

Table 6: Total dose of Tramadol

Variable	Group		t-value	P-value
	A (IT dexmedetomidine)	B (IT morphine)		
	Mean±SD	Mean±SD		
Dose of Tramadol used in mg	8.5±1.9	6.5±1.75	0.356	0.723

There was no significant difference in the mean total tramadol dose required between the two groups.

DISCUSSION

In our study, the mean duration of analgesia with dexmedetomidine group (A) and Morphine Group (B) were 20.30 ± 8.47 hrs and 20.87 ± 8.13 hrs respectively. In our study, rescue analgesia was needed in 16.6% (5/30) of patients in dexmedetomidine group and 13.3% (4/30) of patients in morphine group with, no difference between both the groups clinically. In our study, incidence of PONV was seen in 13.3% (4/30) of patients in dexmedetomidine group and 6.6% (2/30) of patients in morphine group. Pruritus was seen in 6.6% (2/30) of patients in dexmedetomidine group and 16.6% (5/30) of patients in morphine group. Shivering was seen in 10% (3/30) of patients in dexmedetomidine group and 3.3% (1/30) of patients in morphine group. There was no clinically significant difference between both the groups in terms of PONV, pruritus and shivering.

The authors compared IT morphine (250 mcg) and IT dexmedetomidine (5 mcg) as adjuvants to levobupivacaine for spinal anaesthesia in patients undergoing abdominal hysterectomy, They documented that IT morphine as an adjuvant to levobupivacaine provided better analgesia than intrathecal dexmedetomidine group, as the time for the first analgesic request was 451.63 ± 38.55 min in morphine group as compared to the dexmedetomidine group 320.80 ± 41.75 min.[6]

The Dexmedetomidine group demonstrated a significantly shorter duration of analgesia, with patients requesting rescue analgesia earlier due to the earlier onset of postoperative pain. Nearly half of the patients in dexmedetomidine group (51.4%) required their first rescue analgesic within 6 hours after surgery.[7] In our study, IT administration of dexmedetomidine at 5 mcg was found to offer an analgesic duration of 20.30 ± 8.47 hrs, probably due to combined GA with IV fentanyl intraoperatively and scheduled multimodal non-opioid analgesics in the intraoperative and postoperative period.

In a prospective, randomized comparative study, involving 100 patients, conducted by Syed Sajjad Alam et al on effectiveness of IT dexmedetomidine (10mcg) with 10 mg of 0.5% bupivacaine with 0.5 ml of normal saline versus 10 mg of 0.5% IT bupivacaine with 0.5ml of normal saline in lower abdominal surgeries, the authors have documented that dexmedetomidine with bupivacaine provided longer duration of analgesia for up to 12 hours than bupivacaine alone,[8] affirming that dexmedetomidine prolongs the duration of analgesia when given intrathecally.

In a randomized, controlled, double blinded study conducted by Shagufta Naaz involving 100 adult patients on the optimal dose of IT dexmedetomidine (5,10,15 and 20mcg) in average Indian adult patients presenting for lower abdominal surgeries, the authors documented that 10mcg of IT dexmedetomidine was found to be an optimal dose in offering prolongation of anaesthesia and analgesia with minimal side effects.[9]

In a prospective, randomized trial, conducted by Ahmed Hamody Hassan et al, involving 90 adult patients, aged 20 to 75 years on the comparison of IT morphine (200mcg) with 10 mg of 0.5% levobupivacaine vs IT dexmedetomidine (5 mcg) with 10 mg of 0.5% levobupivacaine vs combined IT morphine- dexmedetomidine (200mcg-5mcg) with 10 mg of 0.5% levobupivacaine in infra umbilical surgeries, the authors found that 23.3% of patients belonging to morphine group had pruritus, whereas none of the patients belonging to dexmedetomidine group had pruritus.[10]

In a meta-analysis of RCT conducted by Shuyan Liu et al involving 1478 patients from 25 clinical trials on the comparison of IT dexmedetomidine (5mcg) with IT bupivacaine versus placebo on spinal anaesthesia, the authors documented that 17 trials reported the incidence of PONV, showing no significant difference between the IT dexmedetomidine group and placebo group. However, data from 14 studies involving 851 participants demonstrated that IT dexmedetomidine group had reduced incidence of shivering by 61%.[11]

In a meta-analysis of RCT conducted by E.Gonvers et al including 29 trials on the evaluation of different doses of IT morphine versus a control group in spinal anaesthesia for hip and knee arthroplasty, the authors found that the incidence of PONV between IT morphine group and control group were similar with morphine dose of up to 100mcg and the incidence increased with morphine doses more than 150 mcg,[12] validating our study results.

In a randomized, double blinded study conducted by Didem Onk et al including 90 patients on the comparison of shivering during spinal anaesthesia

between IT morphine (100mcg) with 5 mg of 0.5% bupivacaine versus IT fentanyl (25mcg) with 5 mg of 0.5% bupivacaine versus IT 5 mg of 0.5% bupivacaine with saline in patients undergoing endovenous ablation of varicose veins, the authors documented that both 25mcg fentanyl and 100 mcg morphine when added to bupivacaine may prevent shivering during spinal anaesthesia.[13] In our study, 3.3% of patients in morphine group had shivering. However, the differences between both the groups were insignificant. In our study, 15% (9/60) patients required a single dose of tramadol and none of them required > 1 dose. Among the 9 patients- 16.6% (5/30) patients belonged to dexmedetomidine group and 13.3% (4/30) patients belonged to Morphine group.

Our study has few limitations

The study was a single centre study conducted with easier accessibility to tertiary health care services. A multi-centric study with increased sample size undertaken among a varied study area including various urban and rural areas would be more informative. The study was done only in ASA I and ASA II patients which cannot be extrapolated for higher ASA grades and paediatric age groups. The administration of GA in both groups may be a confounding variable in the assessment of analgesic duration in the perioperative period.

CONCLUSION

In this prospective, randomized, double blinded clinical trial, we conclude that both intrathecal dexmedetomidine and Intrathecal morphine are equally effective adjuvants to general anaesthesia with prolonged duration of analgesia up to 24 hours. Both the study drugs are found to be clinically safe with no significant adverse effects during perioperative period.

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