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Dexmedetomidine infusion impact on recovery profile, quality of recovery, and postoperative analgesia in lower abdominal surgeries: A prospective observational study

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Abstract

Background: Measurement of patient health status, or quality of life, has become an important end-point in clinical studies as it represents in part the patient perception of their outcome of care. The objective of this study was to evaluate the effects of systemic dexmedetomidine on intraoperative hemodynamics, postoperative quality of recovery and analgesia.
Materials and Methods: 90 subjects posted for elective lower abdominal surgeries under general anesthesia were randomized to receive infusion of dexmedetomidine (1 mcg/kg over 15 minutes followed by a 0.06 mcg/kg/h infusion until the end surgery) (Group 1) or Normal saline (10 ml over 15 minutes followed by infusion @1ml/kg/hr till end of surgery) (Group 2). Intraoperative hemodynamics, extubation variables, postoperative analgesic requirement and quality of recovery score were evaluated.
Results: Intraoperative infusion of dexmedetomidine resulted in maintained hemodynamics, achieving early extubation parameters. Time for first postoperative analgesic requirement was increased while total analgesic requirement was decreased with use of dexmedetomidine. Median QoR-40 score was better with the use of dexmedetomidine compared to control group.
Conclusion: Use of Intraoperative infusion of dexmedetomidine was associated with early recovery, decreased postoperative analgesic requirement better Quality of Recovery score signifying greater patient satisfaction.

Keywords: Dexmedetomidine, Quality of recovery-40, Postoperative analgesia, hysterectomy, General anesthesia.

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1. Introduction

Postoperative pain is an inevitable consequence of surgical trauma and remains a significant determinant of delayed recovery and patient dissatisfaction. Inadequate management of acute postoperative pain can adversely affect early mobilization and may predispose patients to chronic pain syndromes.[1] Effective postoperative analgesia is therefore an essential component of perioperative care. Numerous studies have demonstrated that nurses and doctors tend to overestimate the duration of action and effects of the drugs, as well as their concern about respiratory depression, vomiting, sedation, or dependence, which causes initial postoperative pain to be undertreated. Following abdominal surgery, epidural analgesia with local anesthetic looks particularly appropriate because it lowers surgical stress, provides better dynamic pain relief that allows forced motion, and enhances gastrointestinal function. However, numerous randomized trials have called into question the advantages of epidural analgesia. Epidural catheter insertion is sometimes contraindicated, presents some

risk, or the patient may decline.[2] Multimodal analgesia improves pain control while reducing opioid-related adverse effects.[3] Increasing emphasis is now placed on patient-centered outcomes, including quality of recovery and satisfaction, as key indicators of perioperative success.[4] The Quality of Recovery-40 (QoR-40) questionnaire having validated tool that assesses postoperative health status across five domains and comprehensively measures patient-perceived recovery.[5]

The selective α-2 adrenergic agonist dexmedetomidine can be used for sedation, anxiolysis, or analgesia by acting on the locus coeruleus and modulating descending inhibitory pain pathways. Its anesthetic- and opioid-sparing effects may facilitate smoother recovery and improved postoperative outcomes.

This study evaluated how perioperative dexmedetomidine infusion affected patients undergoing lower abdominal surgeries under general anesthesia in terms of recovery profile, postoperative analgesia, and QoR-40 scores.

2. Materials and Methods

After receiving written consent from the patients and institutional ethical approval, this prospective randomized experiment was carried out. 90 patients between the ages of 20 and 60 who were scheduled for elective lower abdominal surgeries under general anesthesia and categorized as "American Society of Anesthesiologists (ASA)" I & II patients made up the study. ASA grade III & IV patients, age > 60, BMI >35 kg/m^2, and allergies to local anesthetics were among the exclusion criteria along with history of substance abuse prior to surgery, uncontrolled hypertension, A-V conduction block, psychotropic, opioid, analgesic, and beta-blocker use, as well as sleep apnea.

By using computer-generated randomization, patients who met the inclusion criteria were divided into 2 groups and given injections. After giving 1mcg/kg of dexmedetomidine for 15 min, Group 1 received an infusion of @0.6mcg/kg/hr through the procedure. Group 2 received 10ml of normal saline over the course of 15min, followed by an infusion of @1ml/kg/hr until the end of the procedure. Inj was used to produce anesthesia in each group. Fentanyl 2mcg/kg, injection of 1-1.5mg/kg of propofol until verbal commands are lost. 0.1 mg/kg of vecuronium was used to produce neuromuscular blockade. A cuffed endotracheal tube of size 7–7.5 has been used to complete the endotracheal intubation. 66% N_2O in O_2, increasing isoflurane concentration, and intermittent boluses of injectable fentanyl (1mcg/kg) and vecuronium (1mg) were used to maintain anesthesia. During the perioperative phase, BIS (Bispectral Index) was kept among 40-60. Any reduction in BIS has been kept via adjusting isoflurane concentration. Following surgery, the corresponding infusions were discontinued. After full oral suction, the resumption of spontaneous effort, and a BIS value among 80-100, the neuromuscular blockade was reversed by the combination of inj. Neostigmine (0.05mg/kg) and inj. Glycopyrrolate (0.01mg/kg). 1gm of intravenous paracetamol was given to each patient for postoperative analgesia 15min before the procedure.

After reversal agents were given, the time for eye opening, verbal command response, and endotracheal tube removal was recorded.

The Aldrete score was used to evaluate discharge from PACU, and patients were moved to the postoperative ward when the score was ≥ 9.

Tramadol 100 mg IV for 8 hrs a day was used to sustain analgesia during the postoperative time. When VAS is ≥ 5, rescue analgesia will be given in the form of an additional bolus of injectable tramadol 100mg. The total amount of tramadol injections received within the first 24hrs have been recorded. Additionally, patients were observed for any complications, including nausea, vomiting, and the first passage of flatus.

On the 5 postoperative days, a 40-point QoR score (QoR-40) was evaluated to determine the quality of recovery, and each patient's overall score was determined.

As per prior study, 42 patients were required in each group to detect a difference of 10 in QoR-40 scores with a power of 80% and a significance level of 0.05. To prepare for any dropouts, we included 45 patients in each group (**Table 1**-**Table 4**).

"Microsoft Office Excel 2007" & "IBM SPSS version 22" were used to statistically analyze the data. The mean or standard deviation has been utilized to describe quantitative data, whereas the median, range, frequencies, and percentages were used to express qualitative data. The independent sample t-test has been utilized for comparing mean of the continuous variables. $P < 0.05$ considered significant in non-parametric tests (Kruskal Wallis) when the data was not normally distributed.

3. Results

Table 1: Demographic profile

	Group 1	**Group 2**	**p value**
No. of patients(n)	45	45	
ASA I/II	28/17	31/13	0.382*
Age in years (Mean±S.D.)	45.33±6.41	45.02±7.60	0.919**
Weight in Kgs (Mean±S.D.)	57.75±6.94	58.03±8.83	0.066**

Table 2: Recovery and extubation parameters

	Group 1 (n=45)	**Group 2 (n=45)**	**p value**
T1(mins) Mean±S.D.	2.68±1.48	2.75±1.76	0.175
T2(mins) Mean±S.D.	3.4±3.31	4.51±3.40	0.71
T3(mins) Mean±S.D.	3.73±3.24	4.57±3.34	0.165
T4(mins) Mean±S.D.	11.15±4.20	11.11±3.38	0.631

T1-time of extubation after after reversal of neuromuscular blockade (T0),
T2-time of eye opening after T0
T3-time of verbal response after T0,
T4- time to achieve alderate score ≥9 after T0

Table 3: Postoperative analgesic requirement

	Group 1 (n=45)	**Group 2 (n=45)**	**p value**
Time for requirement of first analgesic (mins) Mean± S.D.	98.64±172.68	40.66±30.02	0.001
Total dosage(mg) Mean± S.D.	448.88±123.60	560.00±115.00	0.001

Table 4: Quality of recovery score

Parameters	**Group 1 (n=45)**	**Group 2 (n=45)**	**p value**
QoR40 [median(IQR)]	180(177-188)	178(171-180)	0.014

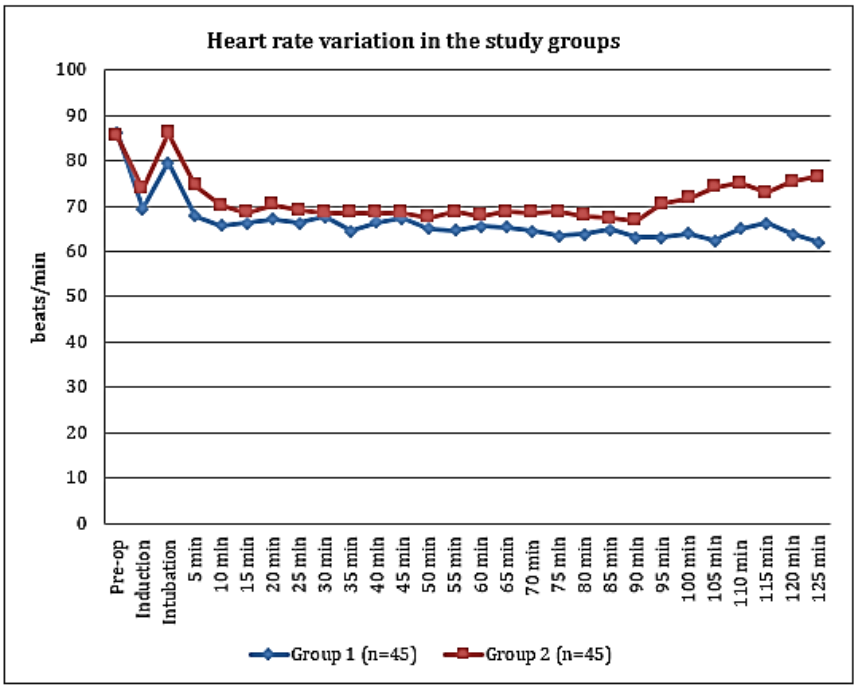

Figure 1: Heart rate variation in the study groups

Hemodynamic parameters such as HR and mean BP were similar in both groups and statistically not significant

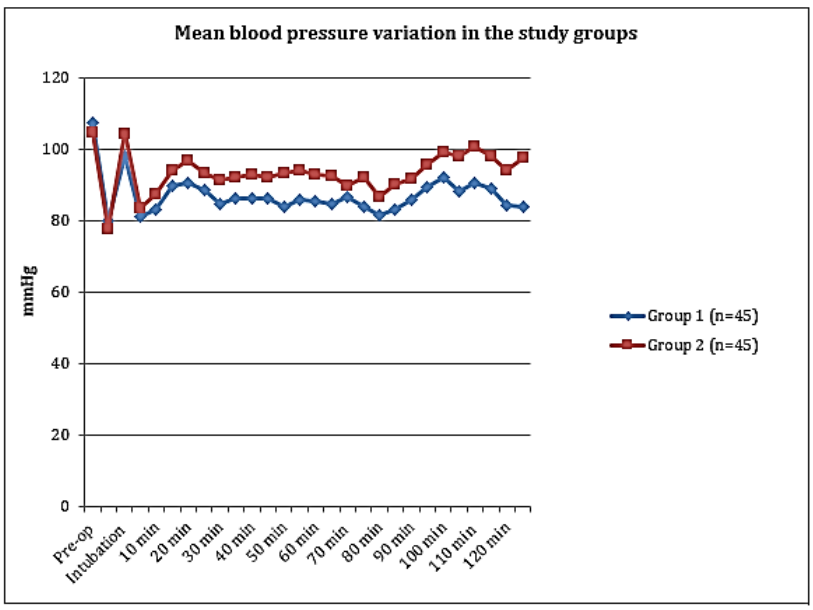

Figure 2: Mean blood pressure variation over time in the two study groups

4. Discussion

Reduced cardiac output, systemic vascular resistance, myocardial contractility, and systemic blood pressure are all hemodynamic effects of α-2 agonists. An intravenous bolus of dexmedetomidine causes a biphasic hemodynamic response. A quick intravenous infusion of 2 mcg/kg caused the heart rate to decrease from baseline and the blood pressure to initially rise. Dexmedetomidine's vasoconstrictive effects when stimulating peripheral α 2 receptors are probably the cause of this initial increase in blood pressure (BP).[6,7] A decrease in heart rate and blood pressure follows this.

Intubation leads to an increase in hemodynamic parameter encompassing HR, SBP, DBP or MAP. Changes were maximum in control group and least with infusion of dexmedetomidine. These effects usually persisted for up to 5 min post intubation thereby they stabilized. But as compared to a placebo, the dexmedetomidine group's scores were the lowest.

In their study, Patel et al. discovered that, in comparison to a placebo, Dexmedetomidine infusion has been associated with a reduced increase in SBP, DBP, MAP, or HR compared to baseline, as well as a decrease in these parameters.[8]

Tanskanen et al., also in their study, demonstrated that intraoperative infusion of 0.4mcg/kg/hr of dexmedetomidine maintained heart rate and BP in acceptable range.[9]

In a study of 80 patients receiving dexmedetomidine (0.8mcg/kg bolus, 0.4mcg/kg/hr in group D) and normal saline in the same volume and rate (group P), Bakhamees HS et al. examined the impact of dexmedetomidine on anesthetic requirements during surgery, recovery profile, or morphine use in the postoperative period. They discovered that dexmedetomidine group had a better recovery profile than the placebo group. They postulated that decrease use of perioperative fentanyl and propofol for maintenance of anesthesia was the probable cause of early recovery.[10]

Similar results were noted by Norimasa et al, and they concluded that dexmedetomidine did not impact postoperative cognitive.[11] However, in a study done by Mohamed S et al extubation time and post-op orientation time were significantly prolonged in patient receiving dexmetomidine group compared to placebo. They attributed dexmedetomidine's sedative for the delay.[12]

Dexmedetomidine affects the descending medullo-spinal noradrenergic system and operates on the locus coeruleus. Furthermore, it affects the spinal cord by activating α2 receptors at the substantia gelatinosa of the dorsal horn, inhibiting the firing of nociceptive neurons, and preventing the release of substance P. Dexmedetomidine's spinal, supraspinal, or local systems of action resulting a reduction in the release of nor-epinephrine or possible analgesia.[13]

Our research showed that patients receiving a dexmedetomidine infusion had a lower overall tramadol dosage within the first 24 hours. The mean dose of tramadol was 560.00±115.00 (group 2) and 448.88±123.60 (group 1). Similarly, the first dosage of analgesic in postoperative period was longer with its use of dexmedetomidine

Our study was corresponding to the study of Gurbet et al., Blaudszun G et al., who found a decrease in dosage of postoperative analgesic and duration of need for first rescue analgesic using lignocaine and dexmedetomidine during surgery.[14,15]

The lack of PCA (patient-controlled analgesia) for postoperative analgesia was a limitation of our study. Fixed analgesia dosage causes peak and trough effects and inadequate analgesia. Non-availability of PCA in our setup was a major drawback in assessing postoperative analgesic requirement.

A global measure of recovery quality is the QoR-40. Patient support, comfort, emotions, physical independence, or pain are the five aspects of health that are included; each item is scored on a 5-point Likert scale. A number of 40 indicates very poor QoR, whereas a score of 200 indicates high QoR.

Our study demonstrated the median (IQR) QoR-40 has been 178(171-180) in group control and 180(177-188) in Group dexmedetomidine. It showed that the best recovery profile in postoperative period was present in patients of dexmedetomidine group significant to saline group. This might have been caused by dexmedetomidine pharmacological effects on inflammation, decrease in opioid consumption and nausea –vomiting. QoR-40 Dimension was best in group dexmedetomidine for all the dimension of QoR-40 score.

In conclusion, the intraoperative infusion of dexmedetomidine was related to early recovery, an improved QoR score, which indicates higher patient satisfaction, and a lower requirement for postoperative analgesics.

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Nil.

Conflict of Interest

Nil.

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