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Effect of dexmeditomedine with levobupivacaine on duration of transversus abdominis plane blocks compared to levobupivacaine with normal saline: A prospective, randomized and double blind study

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Abstract

Background: We performed a prospective, randomised, double‑blind study to evaluate the effect of dexmeditomedine added to levobupivacaine on the duration of transversusabdominis plane block.

Methods: Sixty American Society ofAnaesthesiologist's physical status I and II patients undergoing electivetotal abdominal hysterectomysurgery under general anaesthesia were randomly allocated to either Group C (control group) or Group D (dexmeditomedine group). Group C (control group) patients were received TAP block on each side using 32ml of study medication, which consisted of 30ml of levobupivacaine 0.25% and 2ml of normal saline. Group D (dexmedetomedine group) patients were received TAP block on each side with 32ml, in which dexmedetomidine 0.5 micrograms/kg was dissolved in 2ml of normal saline and added to 30ml of levobupivacaine 0.25%. The duration of analgesia and level of sedation and complications and sleep diturbanse were evaluated and recorded at 1hr, 4hr, 8hr, 12hrs, and 24hrs.

Results: Demographic and operative characteristics were comparable between the two groups. The time for the first analgesic dose was longer in Group D than Group C 425.95 (18.06) vs. 78.2 (71.07) min, P<0.001) and the total doses of used fentanyl were less among Group D patients in comparison to those in Group C80.35 (19.16) vs.342 (15.89), P<0.001). Visual analog scores were significantly lower in Group D in the first 8 h post-operatively when compared with Group C, both at rest and on coughing (P<0.001). In Group D, lower heart rate was noticed from the induction time and continued for the first 24 h post-operatively.

Conclusion: Addition of dexmeditomedine to 0.25% levobupivacaine in transversusabdominis plane block significantly prolongs the duration of analgesia.

Keywords: Dexmeditomedine, Levobupivacaine, Postoperative pain, Total abdominal hysterectomy, Transversusabdominis plane block.

Introduction

The transversusabdominis plane (TAP) block is a recently expanding regional anaesthesia technique that provides analgesia following abdominal surgery. This block was first described in 2001 by Dr Rafi.[1] His technique involved the

identification of the triangle of Petit, an anatomical formation first described by Jean Louis Petit (1674-1750). The triangle is formed anteriorly by the free posterior border of the external oblique muscle, posteriorly by the anterior border of latissimusdorsi and inferiorly by the iliac crest[2]. The area of the triangle is occupied by the internal oblique superficially and the transversusabdominis underneath.

Gynecological surgeries are often associated with severe pain requiring a well-planned analgesia regimen to ensure adequate patient-comfort, satisfaction, early mobilization, and to decrease the hospital/post-anesthesia care unit (PACU) stay.

Nowadays different drugs have been used as adjuvant with local anesthetics in transversusabdominis plane block to achieve quick, dense and prolonged block[3,4]. Drugs like morphine, pethidine, butorphanol, buprenorphine are commonly used along with local anesthetics for this purpose. Since morphine, buprenorphine, pethidine are associated with side effects like heavy sedation, respiratory depression and psychomimmetic effects, drugs with minimal of these side effects are always looked for.

Dexmedetomidine is a selective alpha 2 (α2) adrenergic agonist with both analgesic and sedative properties.[5]Its use with bupivacaine either epidurally or intrathecally associated with prolongation of the LA effect

In this study, we assess the analgesic effect ofadding dexmedetomidine to levobupivacaineon TAP block for patients undergoing abdominal hysterectomy.

Source of data

60 patients undergoing elective total abdominal hysterectomy under general anaesthesia in Rajiv Gandhi Institute of medical sciences college and Hospital, Kadapa, Andhra Pradesh, satisfying the inclusion criteria were randomized into two groups based on block randomization during the study period from June 2013 to March 2014.

Inclusion criteria:

1. Patients belonging to ASA physical status 1 and 2.
2. Patients between 40-60 years.
3. Elective total abdominal hysterectomy surgeries

Exclusion criteria:

1. Patients belonging to ASA physical status 3, 4 and 5.
2. Patients with Aortic Stenosis.
3. Patients with history of left ventricular failure.
4. Patients with Atrioventricular Conduction Block.
5. Patients taking Beta blocking drugs, MAO inhibitors.

Materials and methods

The study protocol was approved by the Institutional Ethical Committee. Written Informed Consent was taken from each subject willing to enter the study. Preanaesthetic checkup and routine investigations like complete blood count, serum creatinine and ECG were done. Patients were kept nil by mouth for 6 hours. All patients received tab alprazolam 0.5mg orally on the night before surgery. Sixty ASA grade I and II patients undergoing elective total abdominal hysterectomy were randomly assigned to of the two groups: Group C (Control group) and Group D (Dexmedetomidine group). Patients were premedicated with glycopyrrolate 0.02 mg/kg in the preoperative room.

Patients included in this study were randomly allocated into two groups.

Group C (control group): patients were received TAP block on each side using 32 ml of study medication, which consisted of 30 ml of levobupivacaine 0.25% and 2 ml of normal saline.

Group D (dexmedetomedine group): patients were received TAP block on each side with

32 ml, in which dexmedetomidine 0.5 micrograms/kg was dissolved in 2 ml of normal saline and addedto 30 ml of levobupivacaine 0.25%.

On arrival in the operation theatre, monitors were attached and baseline parameters such as heart rate, systemic arterial pressure and peripheral oxygen saturation and level of sedation were noted down.

After pre-oxygenation for 3 minutes, anesthesia was induced with a standard anesthetic protocol using midazolam 0.05 mg/kg, fentanyl 1 μg/kg, propofol 2mg/kg followed by succinyl choline, 2 mg/kg to facilitate tracheal intubation; trachea was intubated with an appropriate sized cuffed, endotracheal tube. Lungs were mechanically ventilated with O2 - N2O (30-70), sevoflurane 0.8%MAC, and vecuronium bromide 0.01 mg/kg bolus followed by 1 mg intermittently for neuromuscular blockade. Tidal volume and ventilator frequency were adjusted to maintain normocapnia (EtCO 2 40 ± 4 mmHg).During surgery, Ringer's lactate solution was administered in maintenance dose as per Holiday Segar formula.

The TAP block was performed at the end of operation, before extubation.Following skin preparation, TAP blocks were performedusing 18G Tuohyneedle using the mid‑axillary landmark, piercing the skin two inches cephalad to the iliac crest with a "double‑pop"technique.After negative aspirationa total volume of 32ml of study solution in two divided doses on either side is administered.

At the end of operation, neuromuscular blockade was antagonized with injection of neostigmine 0.05 mg/kg and glycopyrrolate 0.02 mg/kg intravenously and patient was extubated when respiration was deemed sufficient and they were able to obey commands. Patients were transferred to recovery room. In the postanaesthesia care unit (PACU) they were monitored for any evidence of complications or adverse events.

Degree of sedation and intensity of pain were assessed by using VAS scale (VAS; where 0 = no pain and 10 = worst imaginable pain). Assessments were made immediately after surgery, 1hr, 2hrs, 4hrs, 6hrs and 24 hrs. after the procedure.

Fentanyl 1microgram/kg IV was given as rescue analgesic if post-operative VAS score >3. Rescue antiemetic ondansetron 0.1mg/kg was given to patients who complained of nausea and vomiting. Time to 1st request of rescue analgesic, 24hrs fentanyl consumption, post-operative VAS scores and other side effects like PONV & sedation were analyzed statistically.

The results obtained in the study are presented in tabulated manner.

Statistical analysis was done by students't' test. Chi square test was performed for nonparametric values and corresponding P was computed. P value <0.05 was considered statistically significant.

Table 1: Level of sedation

Score	Level of sedation
0	Awake and agitated
1	Awake and comfortable
2	Asleep and arousable
3	Asleep with sluggish response to verbal commands or touch
4	No response to verbal command or touch

Results

The groups were comparable in terms of age, weight, height, duration of surgery and ASA grading (Table-2).

There were 17 ASA I and 13 ASA II patients in Control group and 16 ASAI and 14 ASA II patients in D group.

Table 3 shows HR readings among both groups in the post-operative period. In Group D lower HR was noticed from the starting time and continued until 24 h post-operatively.

Table 2: Baseline characteristics of the patients in each group

	Group C (n = 30)	Group D (n = 30)
Age (in years)	47.3±9.2	47.7±9.6
Weight (in kg)	68.4±6.5	67.2±6.9
Height (cm)	163.9±8.2	162.6±8.6
ASA PS (I/II)	17/13	16/14
PR (per min)	86.2±6.2	88.1±6.6
MAP (mm Hg)	92.7 ± 9.2	94.6 ± 7.2
Duration of surgery (in min)	64.7 ± 9.2	67.3 ± 12.5
Duration of anesthesia (in min)	86.6 ± 8.8	88.3 ± 8.6

Table 3: Changing in Heart rate during postoperative period among both groups

	Group C (n = 30)	Group D (n = 30)
Base-line	88(88-89)	71(71-71)
1 h	88(88-88)	72(72-72)
4 h	88(88-89)	72(72-72)
8 h	91(91-92)	78(78-79)
12 h	91(91-91)	78(78-79)
18 h	91(91-92)	78(78-78)
24 h	94(94-94)	80(80-81)

Table 4: Mean duration of analgesia and opioid consumption

	Group C (n = 30)	Group D (n = 30)
Time to 1st request of rescue analgesic (min.)	78.25 (71.07)	425.95 (18.06)
Mean 24 hr. fentanyl consumption (micrograms)	342 (15.89)	80.35 (19.16)

The mean time to 1st request of rescue analgesic was 425.95(18.06) minutes in Group D compared to 78.25(71.07) minutes in control Group ($p<0.0001$) (Table-4).

There were no significant differences in the hemodynamic parameters in both the groups throughout the intra operative period.

The incidence of PONV was reduced in the Group D by approximately 50% than the control Group (Table-5).

Table 5: Postoperative sedation scores, incidence of nausea and vomiting and the need for anti-emetic medication in the two study groups

	Group C (n = 30)	Group D (n = 30)
Sedation score upon arrival to PACU	1 (1-1)	1 (1-2)
Sedation score at 1 h	1 (1-1)	1 (1-2)
Sedation score at 4 h	1 (1-1)	1 (1-1)
Sedation score at 8 h	1 (1-1)	1 (1-1)
Sedation score at 12 h	1 (1-1)	1 (1-1)
Sedation score at 18 h	1 (1-1)	1 (1-1)
Sedation score at 24 h	1 (1-1)	1 (1-1)
Incidence of PONV (%)	2(8)	1(4)
Need for antiemetic (%)	2(8)	1(4)

VAS scores for pain were significantly reduced in the first 24 hours at the specific time points assessed after the TAP blockade when compared with the control Group ($p<0.05$, t-test after ANOVA) (Table-6).

Table 6: Mean VAS scores for pain

	Group C	Group D
VAS upon arrival to PACU	2.1+1.18	1.6+1.36
VAS at 1 h	3+1.27	2.4+1.24
VAS at 4 h	4+1.14	2.5+1.283
VAS at 8 h	3+1.57	3+1.67
VAS e at 12 h	3+1.62	2.1+1.183+1.67
VAS at 18 h	2.6+1.14	1.9+1.46
VAS at 24 h	2.8+1.28	2+1.36

TAP block significantly reduced mean analgesic consumption at 24 hrs. ($p<0.001$) (Table-7).

Table 7: Analgesic Requirement, Complications and Sleep Disturbance

	Group C (n = 30)	Group D (n = 30)
Analgesics in PACU Fentanyl 20 μg IV	18	4
Sleep disturbance	8	2

Discussion

In this study, we have compared the analgesic effect by performing the TAP block through injecting 0.25% levobupivacaine with and without dexmeditomedine, 16ml each for the left and the right, at a total of 32 ml, after Elective total abdominal hysterectomy under general anesthesia. Group D showed a significantly lower VAS than that of the Group Control, as assessed at 1hr, 4hr, 8hr, 12 hr, 18hr, and 24 hr after the operation. The amount of Fentanyl used as rescue analgesics in the recovery room after the operation were also remarkably lower in the Group D than the Group Control.

Brummett et al. have showed that high-dose dexmedetomidine in combination with bupivacaine enhanced LA blockade in rats without any neurotoxicity.[6]Many studies have showed that the addition of dexmedetomidine to LA in central neuraxial blocks and in peripheral nerve blockades in human was a safe and effective way to potentiate the LA effect and reduce the required analgesics.[7,8,9]On the other hand, Ozalp et al. have compared dexmedetomidine-ropivacaine mixture to ropivacainealone in patient controlled interscalene analgesia and they reported similar pain scores in both groups without any advantageous effect of dexemedetomidine.[10]Literatures' review did not reveal any study describe the addition of dexemedetomidine to bupivacaine for TAP block. TAP block is an expanding regional anesthesia technique that provides good analgesia to the skin and musculature of the anterior abdominal wall in patients undergoing various abdominal surgeries.[11,12,13] McDonnell et al. in their study contributed the prolonged effect of ropivacaine TAP block to the relatively poorly vascularised TAP resulting in a slower rate of drug clearance.[14]

In a meta-analysis conducted by F.N. Abdallah et al., to assess the duration of analgesic effectiveness after posterior and lateral approaches for TAP block for transverse lower abdominal incisions, concluded that TAP block using posterior approach (through triangle of petit) reduced the rest and dynamic pain scores as well as the consumption of morphine up to 24 hrs. [15]

In the TAP block, a local anesthetics is injected into the T7-T12 intercostal nerve, ilioinguinal nerve, iliohypogastric nerve, and the lateral cutaneous branches of dorsal rami of the L1-L3 at the neurofascial plane between IOM and TAM, in order to block the nerves that dominate the sense of the abdominal cavity [16].Regarding the significant sensory blocking range, McDonellet al. [17] reported that it is in between the T7-L1, based on radioactive examination. Tran et al. [18]reported that the dye injected to the TAP was distributed at the T10-L1, based on the cadaver study. In our study, the sensory blocking range was not precisely assessed because the procedure had performed after induction of general anesthesia. Hence, a systematic research regarding the sensory blocking range and the success rate of the procedures, depending on the diffusivity of local anesthetics, must be performed.

The appropriate dose and concentration of injected local anesthetics also needs to be investigated. McDonnell et al. [12]reported that the dose of morphine used during postoperative 24 hours in the patients who underwent the large bowl surgery with the TAP block that was performed with 0.375%levobupivacaine 20 ml, 10 ml injected to each side, decreased by 70%. They also reported that the total dose of morphine injected by the IV-PCA to the patients who underwent Cesarean section for

48 hours after the operation was reduced by the TAP block that conducted with 0.75% ropivacaine 1.5 mg/kg (Max. 150 mg), as compared to the total dose of morphine used in the controls [14]. In addition, El-Dawlatly et al. [19] reported that the morphine used for 24 hours after the operation of patients who underwent laparoscopic cholecystectomy was significantly reduced by the US-TAP block conducted with 0.5% bupivacaine 30 ml, 15 ml injected in each side. In our study, 0.25% levobupivacaine with dexmedetomedine 32 ml was injected in the patients, and it effectively reduced the pain without any complications when compared with that of the control group. The result that there was significant difference in the effect between the Group D and Group C can be a useful reference for clinical applications.

One limitation of this study is lack of proper assessment of success rate of TAP block procedure as it was performed following the induction of general anesthesia, but we depend upon the skills of the investigators. A second limitation is the inability to assess dexmedetomidine plasma concentration among study patients to determine whether its action was related to systemic absorption or pure local effect.

Conclusion

Addition of dexmedetomedine to local anesthetic drugs in transversusabdominis plane block significantly prolongs the duration of analgesia in patients undergoing total abdominal hysterectomy under general anaesthesiaand is a remarkably safe and cost effective method of providing post operative analgesia.

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