

Effect Of Addition Of Dexmedetomidine To Ropivacaine In Transversusabdominis Plane Block On Post-Operative Pain In Lower Segment Caesarean Section: A Randomized Controlled Trial

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Abstract :

Background: Transversusabdominis plane (TAP) block is regional block that involves innervations of the anterolateral abdominal wall derived from T6-T12. It provides good post-operative pain relief after various abdominal surgeries. Duration of TAP block is limited to effect of administered local anesthetics. Various drugs have been used as adjuvants to prolong the duration of postoperative analgesia. Alpha 2 adrenergic agonists, like Dexmedetomidine have been found to prolong analgesia when used in neuraxial and peripheral nerve blocks.

Materials and Methods: A total of 100 patients scheduled to undergo caesarean section were divided into two groups in a randomized double blinded way. In Group R (n = 50) patients will receive TAP block on each side using 22 ml of study medication, which will consist of 20 ml of ropivacaine 0.25% and 2 ml of normal saline. While Group RD (n = 50) patients will receive TAP block on each side with 22 ml, in which dexmedetomidine 0.5 mcg/kg will be dissolved in 2 ml of normal saline and added to 20 ml of ropivacaine 0.25%. Time to administration of first dose of analgesic, total dose of rescue analgesia, pain scores, hemodynamic data and side-effects were recorded.

Results : The time for first analgesic dose was longer in Group RD than Group R [280 vs. 190 min, $P < 0.001$] and the total dose of Tramadol used in the first 24 hours was less among patients in Group RD when compared with those in Group R [71 vs. 98 mg, $P < 0.001$]. VAS was significantly reduced at all post-operative points for the first 6 h in Group RD compared with Group R, [$P < 0.05$]. Sedation was found to be statistically significant for the first hour where patients of group RD were more sedated than group R. Changes in Systolic, Diastolic and Mean arterial Pressure and heart rate, were statistically insignificant in both groups. The incidence of Headache, nausea and vomiting and Dryness of mouth were not statistically significant in both the groups.

Conclusion: The addition of dexmedetomidine to ropivacaine in TAP block helps achieve better analgesia and decreases the total dose of analgesics required post-operatively without any major side-effects.

Keywords: caesarean section, dexmedetomidine, analgesia, post-operative, ropivacaine, transversusabdominis plane block.

I. Introduction

In India the rate of caesarean section delivery overall is 10 percent (IIPS, 2007) [1] which is lower compared to some developing nations But even this seemingly small percentage affects a huge number of people [2].

Inadequate control of post-operative pain leads to several unwanted effects like patient's discomfort, prolonged hospital stay and thromboembolic complications. Analgesic multimodalities have been used for relief of post-operative pain including Opioids and NSAID. Although opioids are most widely used to effectively control post-operative pain, they are associated with many side-effects [3]. Epidural analgesia is another modality to control pain, it needs added care, has its own complications and might be contraindicated in some patients [4]. Transversusabdominis plane (TAP) block is a peripheral nerve block that can provide anaesthesia to the anterolateral abdominal wall derived from T6-T12 [5] and hence provides adequate post-operative pain relief following the various abdominal and pelvic surgeries [6-9]. Duration of analgesia with TAP block is limited by the duration of action of local anesthetics (LA). The options to prolong the duration of the block

include the use of an infusion catheter [10,11] and addition of adjuvant medications like α_2 agonists, dexamethasone etc., to LA [12].

Dexmedetomidine is a selective alpha 2 (α_2) adrenergic agonist with both analgesic and sedative properties [13]. Its use with LA in regional blocks is associated with prolongation of the LA effect [14-18]. In a prospective, double-blinded, randomized study, we try to determine the analgesic advantage of adding dexmedetomidine to ropivacaine on TAP block for patients undergoing lower segment caesarean section.

II. Materials And Methods

After approval from the Scientific and Ethical Committee of our institution, written informed consent was obtained from 100 patients, 18 to 45 years of age, American Society of Anaesthesiologist's physical class I or II patients and scheduled for caesarean section through Pfannenstiel incision. Exclusion criteria were patient refusal, patients with a history of cardiac, respiratory, renal or hepatic disease, local infection at the site of block, psychological disorders, allergy to study medications and coagulation disorders. Randomization was performed using a computer generated program to allocate patients to various study groups using the method of random number. During the pre-operative anesthetic assessment of patients, visual analog scale (VAS) for pain assessment was explained to the patients as a number from 0 to 10 cm, with 0 meaning no pain and 10 meaning the worst pain. Medications (22 ml) were prepared in a 50ml syringe labeled as "study drug" to maintain blinding. All patients, nursing staff, and data collector were blinded to the patient group assignment. Patients were monitored by non-invasive blood pressure, electrocardiogram (E.C.G), pulse oximetry and temperature. Spinal anesthesia was performed in all patients in sitting position with 25 gauge Quincke needle at the L3-L4 interspace and 2 ml of 0.5% bupivacaine (heavy) was given after obtaining free flow of CSF. The TAP block was performed after induction of anesthesia but before surgical incision using complete aseptic technique. Bilateral TAP block were performed with 18 G Tuohy needle with the patient in a supine position and the anesthesiologist standing on the ipsilateral side, the iliac crest was palpated to find the latissimus dorsi muscle insertion, the superior oblique muscle and hence the triangle of Petit was palpated, the skin over the triangle was pinched up and pierced, the needle advanced perpendicular to the skin until resistance indicated that the needle tip has reached the fascial extension of the external oblique muscle, penetrating which resulted in loss of resistance or popsensation, as the needle reached the plane between the external and internal oblique fascial layers. Consequent advancement resulted in second increased resistance and its loss indicating entry into Transversus abdominis plane (TAP). In Group R (n = 50); patients received TAP block on each side with 22 ml of study medication, which consisted of 20 ml of ropivacaine 0.25% and 2 ml of normal saline. Patients in Group RD (n = 50) received TAP block on each side with 22 ml, in which dexmedetomidine 0.5 mcg/kg will be dissolved in 2 ml of normal saline and added to 20 ml of ropivacaine 0.25%.

After the surgery was over, patients were transferred to the post anesthesia care unit and an observer, who was unaware of the study protocol, recorded the pain score on visual analogue scale. Intravenous Tramadol was given as rescue analgesia for postoperative pain relief if pain score > 3 or when it was requested by the patients, the time to first dose of rescue analgesic given was recorded and worst pain score was also noted. The total 24 hours tramadol consumption was recorded. In PACU and in first 24 h post-operatively, MAP, HR, VAS, nausea and vomiting, sedation score, headache and dryness of mouth, were recorded at 1, 4, 6, 8, 12, 18, 24 hours post-operatively. Sedation score was measured by using Ramsay sedation Score.

III. Statistical Analysis

The sample size was estimated on the basis of a single proportion design. We assumed the confidence interval of 20% and confidence level of 5%. Thus, a study with a sample of 100 patients would have 80% power to detect a difference of 5% (45-55%) at the 0.05 significance level. The sample size actually obtained for this study is 96 patients. We include 100 patients with 4% drop out rate (50 for Group R and 50 for Group RD). Results were expressed by standard methods i.e. as mean \pm standard deviation. Chi-square test was applied for physical status. Duration and dose of analgesia was analyzed by unpaired t-test. Statistical analysis was performed by SPSS (version 20.0). P-value was considered significant if <0.05 and highly significant if <0.001.

IV. Results

Demographic data and operative characteristics in the two groups were comparable [Table 1]. Post-operatively, the time to request for first analgesic dose was longer in Group RD than Group R [280 vs. 190 min, $P < 0.001$] [Table 2] and the total doses of used Tramadol in the first 24 h were less among patients in Group RD when compared with those in Group R [71 vs. 98 mg, $P < 0.001$] [Table 2]. VAS was significantly reduced at all post-operative points for the first 8 h in Group RD when compared with Group R, [$P < 0.05$] [Table 3]. Sedation was found to be statistically insignificant in both groups except for the first hour where patients of group RD were more sedated than group R [Table 4]. Changes in heart rate, Systolic, Diastolic and Mean arterial Pressure

readings were not statistically significant in both groups. The incidence of Headache, nausea and vomiting and Dryness of mouth were not statistically significant in both the groups [Table 5].

Table 1: Demographic data and operative characteristics in the two study groups

Variable	Group R	Group RD	P Value
Age (Year)	27.4±4.7	28.1±6.08	0.535
Weight (Kg)	52.9±3.7	53.6±4.08	0.335
Height (cm)	152.1±4.88	154.1±6.39	0.079
Duration of surgery (min)	42.4±4.16	44.2±3.24	0.018

Table 2: Showing time to first request for analgesia and total analgesic requirement

Variable	Group R	Group RD	T-Value	P-Value
Time to first request analgesia (min)	190.2±6.1	280.58±8.17	62.679	< .001
Total analgesic dose (mg) in 24 hours	98±34.9	71±24.9	4.453	< .001

Table 3: Showing the visual analog score

VAS	Group R		Group RD		T value	P value
	Mean	SD	Mean	SD		
Immediate post op 1 hour	0.00	0.00	0.00	0.00	-	-
1 hour	0.00	0.00	0.00	0.00	-	-
4 hour	2.7	1.39	1.88	1.17	3.1524	0.0021
6 hour	2.8	1.4	1.60	1.00	3.0122	0.0030
8 hour	3.6	1.87	3.32	1.69	0.7855	0.4340
16 hour	3.4	1.67	3.12	1.52	0.8768	0.3828
24 hour	2.74	1.42	2.9	1.68	0.6410	0.5230

Table 4: Showing the Ramsay Sedation score

Sedation score	Group R		Group RD		T value	P value
	Mean	SD	Mean	SD		
1 hr	2	0	2.18	0.38	3.2804	0.0014
4 hr	2	0	2	0	-	-
6hr	2	0	2	0	-	-
8hr	2	0	2	0	-	-
16hr	2	0	2	0	-	-
24 hr	2	0	2	0	-	-

Table 5: Showing the Side Effect

Other side effects	Group R	Group RD	P-Value
Nausea	3	5	>0.05
Headache	1	1	>0.05
Vomiting	2	3	>0.05
Dryness of mouth	0	1	>0.05

V. Discussion

This study concludes that the addition of dexmedetomidine to ropivacaine in TAP block provides prolonged post-operative analgesia and better pain control than LA alone. The duration of analgesia was longer, VAS was lower and the need for rescue analgesic doses was less when dexmedetomidine was added to ropivacaine. McDonnell et al. [6] in their study contributed the prolonged effect of TAP block to the relatively poorly vascularised TAP leading to a slower rate of drug clearance.

Carney et al. [9] have shown in trans abdominal hysterectomy, that not only was the median time to first request of morphine longer and the mean 48 hour morphine consumption lesser in the TAP block group in comparison with control group but the postoperative pain score were also significantly lower in TAP block group till 36 h postoperatively. In our study, the addition of dexmedetomidine to ropivacaine in TAP block led to further prolongation of analgesia, less requirement of rescue analgesia and lower VAS pain scores. As described in a study by Yoshitomi et al. [15], alpha-2 adrenoceptor agonists prolonged the time of local anesthesia of lidocaine in a dose-dependent manner. Similar to our finding, many investigators have reported that the addition of dexmedetomidine to various LA agents in different types of peripheral nerve blocks resulted in prolongation of analgesia [16-18]. Marhofer et al. [16] found prolongation of ulnar nerve block duration after addition of dexmedetomidine in ropivacaine used for the block by approximately 60%. Almarakbi et al. [17] also found that addition of dexmedetomidine to bupivacaine in TAP block in patients undergoing abdominal hysterectomy provides better pain control post-operatively.

Dexmedetomidine is associated with side-effects such as sedation, bradycardia and hypotension particularly at higher doses but none were noted in our study probably due to the low dose of the drug and its

slow absorption from the TAP. Rancourt et al, [18] added dexmedetomidine at a dose of 1 µg/kg to ropivacaine in posterior tibial nerve block and found a noticeable decrease in systolic and diastolic blood pressure between 60 and 480 minutes ($P < 0.05$) and decreased heart rate at 1 hr post operatively. Further studies will be required to find the safe as well as effective dose of dexmedetomidine that might lead to further prolongation of analgesia. A limitation of this study is lack of proper assessment of TAP block as it was given following the induction of spinal anesthesia, but we depend upon the skills of the investigators for proper placement of drug in the correct plane. An Ultrasound guided TAP block would have been a more sure technique. The use of Touhy's needle could have been complicated by hematoma formation at the block site though we did not get any such cases. A finer needle could have been used but Touhy's was preferred as it gave a better feel loss of resistance that was of prime importance in placing the drug in the right plane. Another limitation is the inability to assess dexmedetomidine plasma concentration to determine whether its action was related to systemic absorption or pure local effect but as only the analgesia seems to be prolonged without any drug related side effect we assume that the effect was completely regional.

VI. Conclusion

The addition of dexmedetomidine to ropivacaine in TAP block confers better pain control and decreases the total dose of analgesics post-operatively without any major side-effects.

References

- [1] IIPS and Macro International (2007): National Family Health Survey (NFHS-3), 2005-06, India, Vol. I and Vol. II, International Institute for Population Sciences, Mumbai.
- [2] Mishra, U.S., Ramanathan M. (2002): "Delivery-related complications and determinants of caesarean section rates in India". Health Policy and Planning, 17(1):90-98.
- [3] Lo Y, Chia YY, Liu K, Ko NH. Morphine sparing with droperidol in patient-controlled analgesia. J Clin Anesth 2005;17:271-5.
- [4] Christie IW, McCabe S. Major complications of epidural analgesia after surgery: Results of a six-year survey. Anesthesia 2007;62:335-41.
- [5] Rozen WM, Tran TM, Ashton MW, Barrington MJ, Ivanusic JJ, Taylor GI. Refining the course of the thoracolumbar nerves: A new understanding of the innervation of the anterior abdominal wall. Clin Anat 2008;21:325-33.
- [6] McDonnell JG, Curley G, Carney J, Benton A, Costello J, Maharaj CH, et al. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: A randomized controlled trial. Anesth Analg 2008;106:186-91.
- [7] O'Donnell BD, McDonnell JG, McShane AJ. The transversus abdominis plane (TAP) block in open retropubic prostatectomy. Reg Anesth Pain Med 2006;31:91.
- [8] McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. Anesth Analg 2007;104:193-7.
- [9] Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg 2008;107:2056-60.
- [10] Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TAP) block. Anaesth Intensive Care 2007;35:616-7.
- [11] Bjerregaard N, Nikolajsen L, Bendtsen TF, Rasmussen BS. Transversus abdominis plane catheter bolus analgesia after major abdominal surgery. Anesthesiol Res Pract 2012;596536:1-5.
- [12] Ammar AS, Mahmoud KM. Effect of adding dexamethasone to bupivacaine on transversus abdominis plane block for abdominal hysterectomy: A prospective randomized controlled trial. Saudi J Anaesth 2012;6:229-33.
- [13] Coursin DB, Coursin DB, Maccioli GA. Dexmedetomidine. Curr Opin Crit Care 2001;7:221-6.
- [14] Neha Fuladi, Shubhada Deshmukh, Anjali Bhure. Comparative Study of Bupivacaine 0.25% versus Ropivacaine 0.5% in Transversus Abdominis Plane Block for Postoperative Analgesia in Lower Abdominal Surgeries: A Randomised Controlled Trial. Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 17, April 28; Page: 4569-4576, DOI: 10.14260/jemds/2014/2476
- [15] Yoshitomi T, Kohjitani A, Maeda S, Higuchi H, Shimada M, et al. (2008) Dexmedetomidine enhances the local anesthetic action of lidocaine via an $\alpha-2$ A adrenoceptor. Anesth Analg 107: 96-101.
- [16] Marhofer D, Kettner SC, Marhofer S, Weber M, Zeitlinger M. Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: A volunteer study. Br J Anaesth 2012;105:438-42.
- [17] Almarakbi WA, Kaki AM. Addition of dexmedetomidine to bupivacaine in transversus abdominis plane block potentiates post-operative pain relief among abdominal hysterectomy patients: A prospective randomized controlled trial. Saudi J Anaesth. 2014;8(2):161-6.
- [18] Rancourt MP, Albert NT, Côté M, Létourneau DR, Bernard PM. Posterior tibial nerve sensory blockade duration prolonged by adding dexmedetomidine to ropivacaine. Anesth Analg 2012;115:958-62