Original Article

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Anaesthesia Section

Analgesic Efficacy of Dexamethasone and Dexmedetomidine as an Adjuvant to 2% Lignocaine Adrenaline and 0.5% Bupivacaine in Transversus Abdominis Plane Block after Caesarean Delivery

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ABSTRACT

Introduction: The ultrasound-guided Transversus Abdominis Plane (TAP) block is an analgesic technique which involves injection of a local anaesthetic between the internal oblique abdominal and the transversus abdominis muscle planes. It provides analgesia to the cranial branches of T10-L1 nerve roots. It has been a practice to provide analgesia in patients following various surgical procedures including the gynaecological procedures like hysterectomy and caesarean section.

Aim: To assess the analgesic efficacy of dexamethasone and dexmedetomidine as an adjuvant to 2% lignocaine adrenaline and 0.5% bupivacaine in TAP block following caesarean delivery.

Materials and Methods: This was a cross-sectional study conducted at Konaseema Institute of Medical Sciences and Research Foundation (KIMS&RF), Amalapuram, Andhra Pradesh, India for a period of one year from January 2021 to December 2021. One hundred patients with an American Society of Anaesthesiologists (ASA) physical scores of I-II, who underwent caesarean section under the Pfannenstiel incision method under subarachnoid anaesthesia with 0.5% heavy bupivacaine, were enrolled in the study. Group I consisted of patients that received an ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine with adrenaline, and 20 mcg dexmedetomidine. Group II included patients who received ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine adrenaline, and 8 mg dexamethasone. The Electrocardiogram (ECG) recordings and blood pressure were recorded during the block in each patient. This approach enabled a more precise analgesic approach for each individual patient. The patients were assessed for pain up to 12 hours of surgery based on a Visual Analog Scale (VAS), where 0 represented no pain and 10 represented 'the worst pain ever possible.

Results: The mean age in the dexamethasone group was 26.48±3.93 and in the dexmedetomidine group was 25.92±4.13 years. The patients who received ultrasound-guided TAP block with dexmedetomidine were significantly less on-demand of tramadol (p-value=0.005). The patients who received ultrasound-guided TAP block with dexmedetomidine were had significantly lower VAS scores at 4 hours (p-value=0.002), 6 hours (p=0.001), and 12 hours (p=0.3), postoperatively.

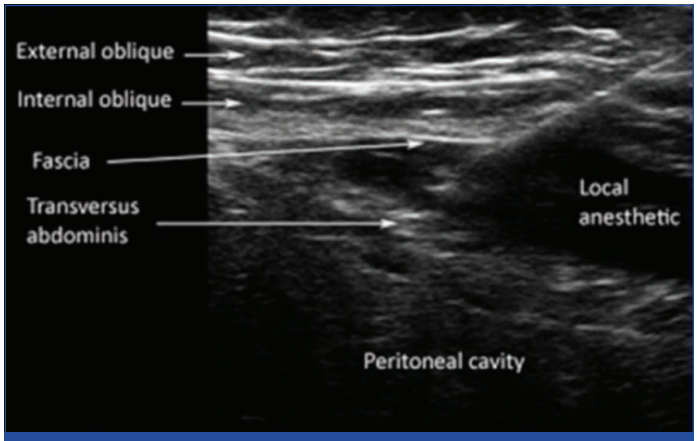
Conclusion: This study proved that dexmedetomidine was more effective when compared to dexamethasone, when added as an adjuvant to 2% lignocaine adrenaline and 0.5% bupivacaine. Ultrasound guided TAP block was a safe and effective postoperative analgesia in caesarean section.

Keywords: Analgesia, Gynaecological procedures, Local anaesthetic, Postoperative analgesia, Visual analog scale

INTRODUCTION

Controlling postcaesarean discomfort is critical, especially in the first 24 hours, to allow for early ambulation and breastfeeding. After a caesarean section, pain management is frequently multimodal, with regional nerve blocks used as part of an opioid free analgesic strategy [1]. The ultrasound-guided TAP block is a technique for analgesia, which involves the injection of a local anaesthetic between the internal oblique abdominal and the transversus abdominis muscle planes [Table/Fig-1]. It was initially performed using the "petit triangle" landmark formed by the latissimus dorsi, external oblique muscles, and the iliac crest [2].

The introduction of Ultrasonography (USG) enabled accurate visualisation of the muscle planes and fasciae of the abdominal wall. It also enabled ultrasound-guided needle injections and monitoring of the local anaesthetic spread [3]. This method has been practiced in patients following laparoscopy, laparotomy, colorectal procedures, laparoscopic cholecystectomy, appendectomy, abdominoplasty, urological procedures, inguinal hernia repair, and gynaecological procedures like hysterectomy and caesarean section [3]. With the use



[Table/Fig-1]: A USG image showing spread of local anaesthetic solution in TAP plane.

of local anaesthetics, Ultrasound-guided (USG) TAP block blocks the neuro afferents from T7-L1 located between the internal oblique and transverse abdominis muscle [4]. Using ultrasound, the accuracy of

local anaesthetic deposition is improved, resulting in more effective sensory nerve blockage and improved analgesic efficacy.

To extend the duration of post operative analgesia, several adjuvants to local anaesthetics such as opioids, ketamine, dexamethasone, and alpha-2 agonists such as dexmedetomidine have been used successfully in peripheral nerve blocks and field blocks [5]. Dexamethasone is a highly strong and selective glucocorticoid which has been used as an adjuvant to the local anaesthetics in a wide variety of nerve blocks, with varying effects on onset but longer duration of analgesia and motor block [6].

A number of studies have assessed the efficacy of only dexamethasone for prolonging the duration of peripheral nerve blocks, but not both dexamethasone and dexmedetomidine. Hence this study was undertaken to assess the analgesic efficacy of dexamethasone and dexmedetomidine as an adjuvant to 2% lignocaine adrenaline and 0.5% bupivacaine in TAP block following caesarean delivery.

MATERIALS AND METHODS

This was a cross-sectional study conducted by Department of Anaesthesiology in collaboration with Department of Obstetrics and Gynaecology at Konaseema Institute of Medical Sciences and Research Foundation (KIMS&RF), Amalapuram, Andhra Pradesh, India, from January 2021 to December 2021. This study was approved by the Ethics Committee with approval No. IEC/CD/2021. A convenient sample size of 100 patients were included in this study.

Inclusion criteria: One hundred patients with an ASA physical status scores of I-II, who underwent caesarean section under the Pfannenstiel incision method, under subarachnoid anaesthesia, with 0.5% heavy bupivacaine were enrolled in the study.

Exclusion criteria: Parturients with a history of recent opioid use, sensitivity to study medicines, substantial renal, cardiovascular or hepatic disease, any contraindication to regional anaesthesia, or local anaesthetic hypersensitivity were excluded from the study.

Study Procedure

Group II received injection tramadol hydrochloride 100 mg intramuscularly immediately after recovery from anaesthesia. Pain intensity was measured using VAS (where, "0"=no pain and "10"=worst pain). The score was classified as painless (0), mild (1-4), moderate (5-8), and severe (9-10) [5,7]. The tool was explained to the patients and, it was administered at baseline (before administration of the drugs) and at 2, 4, 8, 12 and 24 hours, postoperatively.

Subarachnoid block was performed using 26G or 27G Quincke's spinal needle to obtain anaesthesia upto T6 dermatome level. Computer randomisation was used to assign the patients into two groups. Group, I consisted of patients that received an ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine with adrenaline, and 20 mcg dexmedetomidine were administered bilaterally. During the block ECG recordings and blood pressure parameters were recorded in each patient. This approach enabled a more precise analgesic approach to the individual patient. Group II included patients who received ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine adrenaline, and 8 mg dexamethasone [4]. The ECG recordings and blood pressure parameters were recorded during the block in each patient. This approach enabled a more precise analgesic approach for each individual patient. The patients were assessed for pain up to 12 hours of surgery based on a Visual Analog Scale (VAS), where 0 represented no pain and 10 represented 'the worst pain ever possible. The study observation period was limited to 12 hours due to early patient ambulation and motivating them to fill out the pain assessment questionnaire.

The primary outcome was to test the analgesic efficacy of the drugs, time for rescue analgesia (first does with 100 mg tramadol) and pain scores. The secondary outcome was to compare the haemodynamic parameters (heart rate and systolic blood pressure) and adverse effects (nausea, vomiting).

STATISTICAL ANALYSIS

The Statistical Package for the Social Sciences (SPSS) software (SPSS Inc., 2009) was used for statistical analysis, version 24.0 of Predictive Analytics Software (PASW) Statistics for Windows, SPSS Inc., Chicago. Student's t-test or Fisher's exact test were used to analyse demographic data as needed. A paired t-test was used to compare the time to initial analgesic administration and VAS between the two groups. The 95% confidence interval was used. Statistical significance was defined as a p-value of less than 0.05.

Variables	Time in hours (h)	Dexamethasone (Mean±SD)	Dexmedetomidine (Mean±SD)	p-value (paired t-test)
Age (in yrs)		26.48±3.93	25.92±4.13	0.49
Weight (kgs)		58.56±11.85	58.12±10.09	0.84
VAS	0	0±0	0.12±0.44	0.06
	2	1.32±0.65	1±0.95	0.05*
	4	3.24±1	2.5±0.86	0.002*
	6	5.1±1.25	3.34±1.15	0.001*
	12	5.14±3.16	4.6±1.92	0.3
Heart rate (per minute)	0	74.76±6.84	77.1±7.21	0.1
	2	74.32±6.33	76.3±6.26	0.12
	4	74.84±6.7	77.54±5.61	0.03
	6	76.04±6.15	77.96±6.3	0.13
	12	73.2±19.48	78.94±7.21	0.06
SBP (mmHg)	0	118.6±8.81	114.4±8.37	0.02*
	2	116.8±7.41	116.2±7.25	0.68
	4	117.6±8.7	115.6±6.75	0.2
	6	117.8±8.4	114.4±8.84	0.05*
	12	112.8±24.66	118.4±9.12	0.14
DBP (mmHg)	0	75±7.63	75.4±9.08	0.81
	2	75±7.63	74.2±8.35	0.62
	4	76±7	74.98±5.42	0.42
	6	74.2±8.35	75±7.63	0.62
	12	75.4±9.08	76±7	0.71

[Table/Fig-2]: Distribution of subjects according to clinical variables and the anaesthetic adjuvants.
*p-value <0.05 is significant; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

RESULTS

One hundred patients included in the study underwent ultrasound-guided TAP block. There were no statistically significant differences in parameters such as height, weight, or amount of bupivacaine used for subarachnoid anaesthesia between the two groups [Table/Fig-2].

The patients who received ultrasound-guided TAP block with dexmedetomidine had significantly lower VAS scores at 4 hours (p-value=0.002), 6 hours (p=0.001), and 12 hours (p=0.3), postoperatively. There was no statistically significant difference in the heart rates between the two groups (p>0.05). The patients who received ultrasound-guided TAP block with dexmedetomidine were significantly less on-demand of tramadol (p-value=0.005).

Vomiting, nausea, and dizziness were reported by three patients from Group I, two patients were from group II and one was from group I. There were no complications or symptoms associated with the TAP block. The distribution of participants on the basis of duration of analgesia has been shown in [Table/Fig-3].

Duration of analgesia (hours)	Dexamethasone	Dexmedetomidine
5	1 (2%)	0
6	2 (4%)	0
7	6 (12%)	0
8	10 (20%)	3 (6%)
9	8 (16%)	4 (8%)
10	16 (32%)	12 (24%)
11	1 (2%)	17 (34%)
12	6 (12%)	13 (26%)
13	0	1 (2%)
Total	50 (100%)	50 (100%)

[Table/Fig-3]: Distribution of subjects based on duration of analgesia.
*Chi-square=32.48; p-value=0.0001, (p<0.05 is significant)

DISCUSSION

The study was primarily aimed at establishing the analgesic efficacy of TAP block in postcaesarean patients. The outcome measures were analgesic efficacy of the drugs, time for rescue analgesia, pain scores, haemodynamic parameters (heart rate and systolic blood pressure) and adverse effects (nausea, vomiting), along with block complications (accidental intravascular injections and haemodynamic alteration). It was found that ultrasound-guided TAP block was effective in providing adequate analgesia. Ultrasound guided TAP block helped to reduce the usage of analgesics in the postoperative period. There was a substantial difference between the two groups, where group II, which included patients who received ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine adrenaline, and 8 mg dexamethasone had an earlier time for rescue analgesia than Group I which consisted of patients that received an ultrasound-guided bilateral TAP block immediately following surgery with 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine with adrenaline, and 20 mcg dexmedetomidine.

As per literature, 86-97% of patients experience postsurgical pain two months postoperatively [7]. The ultrasound-guided TAP block provides analgesia to the cranial branches of T10-L1 nerve roots [8]. Thus, it can be a promising adjunctive analgesic therapy in treating postoperative pain following caesarian delivery, although not all reports confirm this [9]. The addition of morphine to the subarachnoid block in labour analgesia results in a less marked TAP block that does not reduce pain or the use of analgesic drugs [8,9]. In the present study, analgesia was obtained using 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine with adrenaline and 20 mcg dexmedetomidine in group I and 10 mL of 0.5% bupivacaine, 10 mL of 2% lignocaine adrenaline, and 8 mg dexamethasone in group-II, for ultrasound-guided TAP block [2].

In a trial, different dosages of dexamethasone (4 mg or 8 mg) were used with 0.25% isobaric bupivacaine in a TAP block for postoperative analgesia in bariatric surgery. The addition of 4 mg dexamethasone was shown to be equivalent to the administration of 8 mg dexamethasone for TAP block [10]. Because the average weight of the present study parturient was 58 kg, it was decided to use a dose of 0.1 mg/kg dexamethasone. Dexmedetomidine, a highly selective central alpha-2 adrenergic agonist, was used as a second adjuvant to ropivacaine in our investigation [11].

Sedative, anxiolytic, and analgesic effects were all present. Through vasoconstriction and inhibition of hyperpolarisation activated cationic current, it decreases inflammation and extends the duration of nerve block. Dexmedetomidine works by preventing nerve signal transmission across the C and A delta fibres, as well as stimulating the release of encephalin-like compounds at peripheral locations [12]. Dexmedetomidine enhances the local anaesthetic effects and prolongs their analgesic duration in this way. When comparing the dexmedetomidine and dexamethasone groups, it was found that the time to the first self-reporting of postoperative pain was considerably shorter in the dexmedetomidine group. In addition, parturient receiving dexmedetomidine as an adjuvant to bupivacaine had a longer mean time to first rescue analgesic treatment on VAS 3 than those receiving dexamethasone [13].

Accidental intraperitoneal and intravascular injections have been linked to blind TAP blockages. Ultrasound guidance permits local anaesthetic to be injected into the correct neurovascular plane, avoiding the blind block's difficulties. There were no problems with ultrasound guided TAP block in this trial. There were no adverse medication reactions or overdoses in either group of patients. There was a limited prevalence of complications and adverse symptoms such as nausea, vomiting, sedation, and others suggests that ultrasound-guided TAP block is a safer option for everyday clinical practice. A study evaluating dexamethasone and dexmedetomidine as adjuvants to bupivacaine in a USG-guided TAP block found similar results. When compared to dexamethasone with bupivacaine in TAP block for postoperative pain treatment in caesarean section, the authors found that adding dexmedetomidine reduced postoperative discomfort, prolonged analgesia duration, and reduced the need for further analgesics [14].

Bansal P and Sood D [1] compared the efficacy of TAP block following addition of dexmedetomidine (1 mcg/kg) to 3 mg/kg of ropivacaine for postoperative analgesia in caesarean delivery and found similar results. They found that patients who received dexmedetomidine as an adjuvant to bupivacaine were 90 minutes more pain free than those who received ropivacaine alone, and that the mean time to first rescue analgesic in the dexmedetomidine group was 84 minutes longer than in the bupivacaine alone group. This difference could be due to the fact that both groups used adjuvants, whereas only one group in their study used dexmedetomidine. Dexamethasone and dexmedetomidine as an adjuvant in neuraxial and peripheral blocks have been studied extensively to demonstrate their analgesic efficacy and safety. Analgesia is produced by dexamethasone due to its anti-inflammatory or immunosuppressive properties [15]. The effects of perineural dexamethasone combined with local anaesthetics on neuroprotection and anti-hyperalgesia have also been investigated [16].

Limitation(s)

The study was limited by it's small sample size. The study did not examine 24-hour analgesic usage because of the approach utilised which included a brief follow-up period. Furthermore, only pain at rest was measured and not during activity, which is critical for breastfeeding mothers.

CONCLUSION(S)

The addition of adjuvants to the local anaesthetics help in prolonging the duration of the action for effective analgesia. The study proved that dexmedetomidine was more effective when compared to dexamethasone when added as an adjuvant. It can be finally concluded that the ultrasound-guided TAP block is safe and provides effective postoperative analgesia in patients undergoing caesarean section.

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